Computer Science

Text Book for Class XI

Sajjad Heder

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By

Sajjad Heder
Engr. Dr. Mohammad Javed Hyder

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Author: Sajjad Heder

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PREFACE

Computers are general-purpose machines to aid in storage, processing and communication of information. Modern computers can process information not only in text form but also in graphical or voice form. Today, they have found their way into application areas that were not feasible twenty years ago. Rapid increase in number and variety of computer applications has made them a significant part of our lives. Due to the fast growth in IC chip technology during the last quarter of a century our society, our businesses, our homes and our leisure activities are being transformed. Since the first IC chips were made, their power has increased every year while cost decreased and this has caused the computer revolution.

Microprocessors are now so cheap and so small that they can be incorporated into any device or household appliance. It has brought enormous improvements in efficiency and productivity as well as affecting our pattern of work and our leisure.

The Internet and computer networks are playing an important role in our daily life in sending instant E-mail messages, searching specific information, advertising a product, making a purchase, etc.

This second edition of class XI textbook is written according to the new improved syllabus. It presents an introduction to information technology, computer architecture, computer networks, data communication systems and application of computers. It also includes a practical introduction to Windows operating system, word-processing, spreadsheet and the Internet.

I am grateful for the helpful comments provided by the users of the first edition, many of which have been incorporated into this revision. I hope the improvements that have been made in this edition will provide instructors, students and all others users a better way for learning about computers.

Engr. Sajjad Heder
M.S. Computer Science, George Mason University, USA.
B.E. Mech. Engg. Kim Check Engineering College, Korea.

Engr. Dr. Mohammad Javed Hyder
Ph.D. Mech. Engg. Rensselear Polytechnic Institute, USA.
M.S. CAD, Mech. Engg. George Washington University, USA.
M.Sc. Nuclear Engg. Quaid-i-Azam University, Pakistan.
B.E. Mech. Engg. Kim Check Engineering College, Korea.

INTRODUCTION

Fast growing computer science education has taken its due place in our education system. Both in public and private sectors, it is flourishing rapidly and has become an integral part of our soci0-economic life. In order to bring our future generation intellectually and skillfully at par with the global experiences, the government of Pakistan has decided to introduce the subject of computer science at secondary and higher secondary levels

To keep our generation updated with the modern world the existing National Curriculum has been modified. Growth of this discipline is driven both by the market forces and new intellectual concepts

The objectives for introducing computer science at higher secondary level are to:

(i) Understanding the basic concepts, theories, principles and laws of computer science and their application in daily life.
(ii) Develop mathematical skill for designing different language programs in computer science.
(iii) Understanding and appreciating the role of information technology in socio-economic and cultural development of society.
(iv) Develop skills for using and promoting Internet techniques.
(v) Provide sound but solid basis for further studies in the discipline of computer science and information technology.

The teachers, students, and readers are requested to go through this book minutely and give their remarks and views so as to improve our future publications.

ARJUNLAL S. SUDHRIA
Technical Editor and Coordinator

CHAPTER 1

BASIC CONCEPTS OF INFORMATION TECHNOLOGY

1.1 INTRODUCTION TO INFORMATION TECHNOLOGY

The world is going through an information explosion. This generation of information has required the development of devices that could store this information and process it to obtain knowledge and update it. The human brain is incapable of storing such large amount of information and retrieving it instantly. This resulted in the development of computers. Moreover, the complexities of computational work are time consuming. Computer has freed the man from the bonded slavery of arithmetic.

What is Information Technology?

Information Technology (IT) is the use of modern technology to aid in storage, processing, analysis and communication of information. Information can be represented in a computer in four different forms as follows:

a) Data

The first method presents the information in its basic and most elementary form, as a string of characters (letters and numbers). We call this ***data***. An item of data may be a name, a price, a quantity, a code number, etc. By itself, an item of data is not of much use. It only makes sense when it is combined with other information.

b) Text

The second method presents the information written as phrases and sentences. This is called ***text***. Although, text is much more longer than a basic item of data but it is much more meaningful.

c) Image

The third method presents the information in pictorial form. This includes charts, graphs, pictures and freehand drawings. This is called ***image***. Information in this form is more comprehensive than an item of data and more meaningful.

d) Voice

The fourth method presents the information in spoken phrases and sentences. We call it ***voice***. Like text, it is much more meaningful than an item of data.

Often we use two or more of these forms of information to convey a message. Sometimes you have to choose between alternative methods of presenting the same information. You should select the method, which most clearly and accurately represents the aspect of real world you are seeking to convey.

The IT Revolution

The growth in electronics over the past quarter century has been phenomenal. What we have seen is not an evolution in technology but a revolution. Our society, our businesses, our homes and our leisure activities are being transformed.

Modern electronics is based upon the microprocessor, one form of microchip, which consists of miniature logic circuits etched onto the surface of a silicon chip. These tiny circuits replace the enormous banks of glass valves used in the earliest computers of the 1940s and 1950s.

A computer that uses a microprocessor as its central processing unit is known as microcomputer or ***personal computer*** (PC). A microprocessor controls the entire operation of a microcomputer. Thus, it is the brain of the microcomputer.

The early computers processed information in the form of data. Modern computers are more powerful and can handle information in other forms, including graphics and speech. However, they work on the same principles as the early models. The main difference between the computer of 30 years ago and the microchips of today lies in the fact that the latter are very small, very cheap, very reliable and very powerful. In fact, ever since the first chips were made in the early 1960s, their power has increased every year while their cost

has decreased. It is this fact, continued over a quarter of a century that has caused the information revolution.

Microprocessors are now incorporated not just into computers, but also into a wide range of other products, from cameras to washing machines and cars. But what has an information processing device to do with a camera, washing machine or car? The answer is that the microprocessor is used as a control mechanism in many of these products.

Microprocessors are now so cheap and so small that they can be incorporated into any device that can benefit from the power of the computer. What this means is that to an increasing extent, appliances are able to control themselves, so that the minimum of human intervention is required. This has had an obvious impact on our lives as it has brought large improvements in efficiency and productivity as well as it has affected our daily life patterns of work and leisure.

1.2 COMPUTER HARDWARE AND SOFTWARE

Programs written in a computer's machine language can be directly executed by the computer's electronic circuits, without any intervening interpreters or translators. These electronic circuits, along with the memory and input/output devices, form the computer's hardware. Hardware consists of devices listed below:

- Input devices to enter the information such as the keyboard, mouse, microphone or scanner.
- The Central Processing Unit (CPU), containing the Arithmetic Logic Unit (ALU) which carries out the arithmetic and logical computations and the control unit which executes commands typed at the keyboard or stored in program.
- Storage is split into short-term memory, using microchips inside the computer which hold data and programs while processing is being carried out and long-term storage, normally using magnetic disks.
- Output devices for communicating the results of the processing such as printer, monitor or loudspeaker.

- The circuitry linking these various devices, consisting of 8, 16, 32 or 64 strands of parallel wires, called buses, along which all the bits that make up each item of the information travel in parallel.

Software, in contrast, consists of computer programs. A computer program is a set of instructions to solve a particular problem. Programs can be stored on magnetic disks, magnetic tapes and other media but the essence of software is the set of instructions that makes up the programs, not the physical media on which they are recorded.

An intermediate form between hardware and software is firmware, which consists of software embedded in electronic devices during their manufacture. Firmware is used when the programs are rarely or never expected to be changed, for example in toys or appliances. Firmware is also used when the programs must not be lost when the power is off.

Any operation performed by software can also be built directly into the hardware and any instruction executed by the hardware can also be simulated in software. Hardware and software are logically equivalent. The decision to put certain functions in hardware and others in software is based on such factors as cost, speed, reliability and frequency of expected changes. There are no hard and fast rules about what must be in hardware and what must be in software. Designers with different goals may make different decisions.

1.3 COMPUTER SOFTWARE

Computer software can be split into two categories, that is, system software and application software.

1.3.1 System software

The system software of a computer consists of a collection of operative programs whose purpose is to make the use of the computer more effective. The customer who buys a computer would usually receive, in addition to the hardware, any available software needed for the effective operation of his computer. A computer without some kind of system software would be very ineffective and most likely impossible to operate.

The production of system programs is a complex task requiring extensive knowledge and specialized training in computer science. System programs

offer several advantages and conveniences to application programmers and computer users in general.

1.3.2 Application Software

This is the software that enables us to do the things that we bought our computer for, such as typing a letter, preparing payroll, playing games, writing music or creating animated displays.

Application software is normally supplied as a package, consisting of the following:

- The software, supplied on floppy disk or CD ROMs.
- A manual, explaining how to use the software.
- Training material, either supplied on disk, CD ROM or in a booklet.

IBM PCs and compatibles are supported by thousands of software packages. Most of these are reasonably priced. The Apple Macintosh is also well supported by application software, though not to the same extent as the IBM PC.

The kinds of application packages that are available include the following:

Record-keeping software
Spreadsheet software
Word processing and desktop publishing software
Business graphics and presentation software
Communication software
Diary systems and other personal productivity tools
Drawing and computer-aided design software
Games
Music synthesis
Painting and animation software
Medical Software

Some packages can perform more than one of these tasks. For example, there are a number of office administration packages such as Office 2000 of Microsoft that will carry out word processing, record-keeping, spreadsheet

work and business graphics. These are called integrated packages because they integrate or bring together these varied tasks.

1.4 INPUT AND OUTPUT DEVICES

Before a computer can get to work solving a problem, it must be given the program and the data if there is any. After it has found the solution, the computer must communicate this solution to the human beings who posed the problem in the first place. The topic of getting information into and out of computers is called input/output or usually just I/O.

Input/output devices are used for communication with the computers. Hundreds of kinds of I/O devices are available today and the number is growing rapidly. A few of the more common ones are listed below:

Cathode Ray Tube (CRT) monitors
Keyboards
Printers
Scanners
Pen and ink plotters that draw graphs
Computer mouse
Microphones
Speakers
Electric light pen

1.4.1 I/O Processors

Some I/O devices can transmit a large amount of data in a short time. If the CPU had to process every character separately, much CPU time would be wasted. To avoid tying up the CPU for long periods of time on I/O, most of the computers have one or more specialized, low-cost I/O processors. Because the I/O is performed by these special processors, the CPU is available to spend most of its time on more difficult computations. The I/O processors can run in parallel with the CPU. In other words, while the CPU is busy in computing, the I/O processors can be doing I/O.

1.4.2 Input Devices

A variety of input devices exist to convert information in any form (data, text, voice or image) into binary pulses recognized by computers. Some of these devices are described below:

Keyboard

The keyboard is still the primary device for inputting information to a computer, though voice input devices may ultimately supersede it. It operates by converting key presses to electronic signals in binary digital form. The typical computer keyboard has the standard character keys found on a typewriter together with a number of special keys described below:

- Function keys, up to 12 in number, positioned above the character keys, which can be programmed by the user or by the software being run, so that a single key depression sends a command or string of commands to the computer.

- The CTRL and ALT keys (short for Control and Alternate), which are always used in conjunction with other keys to issue commands to the computer.

- The backspace key, which deletes the character to the immediate left of the cursor on the screen.

- The four arrow keys, which move the cursor one character position in the direction of the arrow.

- The PgUp and PgDn keys, which are normally programmed to move the cursor one page up or down.

- The Home key, which may be programmed to move the cursor to the left of the screen or the beginning of the document.

- The End key, which may be programmed to move the cursor to the right of the screen or the end of the document.

- The Esc key, which is often programmed to enable you to escape from your currently selected option or task.

The Mouse

The mouse is a hand-held device with a rubber ball protruding from its base. As you push the mouse over the surface of the desk, the movements of the ball are detected by the internal mechanism and converted to electrical signals. These are fed to the computer via a cable and converted by the associated software to corresponding movements of the cursor across the screen. At the front of the mouse's casing are two or three buttons. You press these to perform tasks such as picking options displayed on the screen.

Similar to the mouse is the trackball, used on some computers. In this, the casing remains stationary while the ball, which is at the top, is rolled with the fingers.

The mouse has proved very popular and is now utilized by a great deal of software. In particular, it is much easier to use than the keyboard for the following operations.

- Picking, that is, selecting options from a list displayed on the screen.
- Pointing, that is, moving rapidly from one point to another in a word-processed document, file of records or table of data.
- Drawing, that is, creating lines and other shapes on the screen.

Mouse is an essential part of the hardware on almost all the microcomputers running Windows software and other application software.

Character-recognition Devices

One type of character-recognition device enables the user to input text and numerical data by handwriting it in capital letters on the pressure-sensitive surface using a special pen. An invisible grid of fine wires below the surface detects the shape of the letters, converting them to electrical signals which the computer interprets using special software. Although this device is a genuine replacement for the keyboard, it has never become as popular as keyboard. It has been overtaken by other developments, in particular the advances being made in speech-recognition devices.

Some modern image scanners, described later in this chapter, can also function as Optical Character Readers (OCRs) when used with special OCR software.

These can recognize a reasonable range of typefaces, so enabling printed and typed text to be input to a computer. However, smeared characters and unusual typefaces may be beyond them. In place of a character that they cannot recognize, they will substitute a special symbol. These symbols can be automatically picked out and replaced later on with the aid of spell-checking software.

The Microphone

It is quite easy to convert the spoken word to a digital signal for computer input. The microphone converts audio signals to electrical waves and these can be converted by electronic circuitry in the computer to digital form. What is difficult is the recognition by the computer, of the signal, so that it can handle it in the same way as if it had been typed. Highly sophisticated speech-recognition software is required to be able to match the sound uttered by the user with a vocabulary of sound signals stored in the computer and to display the words on the screen as though they had been entered at the keyboard.

The development of workable speech-recognition systems for the English language has been major goal of many researchers for a number of years. Recently, commercial systems have started to emerge. One major problem is the many inconsistencies between the written and spoken words in English. Japanese, in contrast, is phonetically very precise and so speech-recognition system for those languages were relatively easy to develop and have been used for some time.

A second problem is the fact that there can be wide variations between the speech patterns of one individual and another. To cope with this, the system has to be 'trained' to recognize the user's particular speech. Most systems require him or her to read a passage containing all the words stored in the computer's vocabulary on disk, so that it is able to match what is spoken with what is stored. In this way it constructs speech 'templates' for the user, which it stores for use in all subsequent dictation sessions.

Speech-recognition systems in the past have suffered from either having too limited a vocabulary to be of much use or else, in the case of large vocabulary system, taking far too long to match what was spoken with what was stored in the computer. Recent increases in computer power have greatly speeded things up and voice systems on personal computers have now appeared.

Video Cameras and Scanners

Video cameras are versatile devices, being able to capture images of any type, including solid objects. Scanners are limited to images on paper but they are able to scan each spot on the paper with much greater accuracy than cameras and so are more widely used for this type of input. .

Most scanners incorporate a special sort of camera made up of Charged-Coupled Devices (CCDs). Each CCD receives light from the image and provided the light is strong enough, will generate an electrical charge. This means that light areas or dots of the image are represented by charged cells and dark areas by uncharged cells. As the paper containing the image moves past the camera during the scanning process, these charges create electrical impulses which are fed into the computer where they are interpreted by the scanning software as parts of the image.

The resolution of the typical scanner is 600 dots per inch, which means that it splits each square inch of the image up into a matrix of 600 x 600 tiny areas. This is better than the resolution of most laser printers.

The technology behind this is well understood and quite straightforward. Nowadays, scanners are widely used to get drawings, diagrams and photographs into computer systems for incorporation into documents and books which are made up electronically prior to printing. Much more difficult is the recognition of the image by the computer, so that it is able to act upon what it sees. Just as the speech-recognition system described in the previous section worked by breaking down the spoken word into its phonetic elements, so image-recognition systems work by breaking down the image into component parts, identifying each and analyzing their position relative to each other.

1.4.3 OUTPUT DEVICES

The main output devices are monitors, printers and plotters.

The Monitor

The number of pixels, or picture elements on the screen determines the resolution or clarity of the picture that monitors achieve. High-resolution monitors have resolution of 2000 x 2000 pixels, though few present-day

computers are able to provide images, which take advantage of this degree of clarity. The old-fashioned IBM PC, for example, with a Color Graphic Adaptor (CGA), can only output images with a resolution of 640 pixels horizontally by 200 vertically. This was adequate for character-based displays but for graphics it was hopelessly inferior to the displays of more advanced machines such as the Apple Macintosh.

In the mid-1980s IBM introduced the Enhanced Graphics Adaptor (EGA), which offered a higher resolution. This gave a much better clarity, though it was still not as good as the Macintosh.

Then in 1987, IBM brought out the Video Graphics Array (VGA) on its PS/2 range of microcomputers, with a resolution of 640 by 480. This was quickly taken up by the PC-compatible world and became the standard. In 1990 IBM brought out its Extended Graphics Array (XGA) with a resolution of 1024 by 768 pixels and support for 65000 colors. Super VGA with the same resolution became available from competing manufacturers and this has become the standard.

Cathode Ray Tubes

Most computer monitors are based on Cathode Ray Tubes (CRTs), similar to those used in TV sets. Figure 1.1 illustrates the basic operation of a CRT. A beam of electrons (cathode rays), emitted by an electron gun, passes through focusing and deflection systems that direct the beam towards specified points on the phosphor-coated screen. The phosphor then emits a small spot of light at each point contacted by the electron beam.

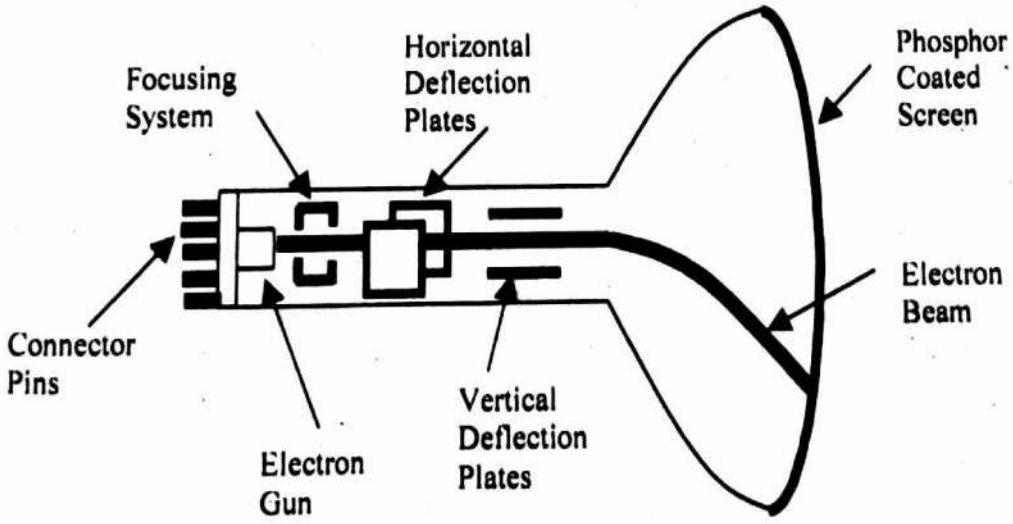

Fig 1.1 Basic design of a CRT, using electrostatic deflection fields.

Since the light emitted by the phosphor fades very rapidly, some method is needed for maintaining the screen picture. One way to keep the phosphor glowing is to redraw the picture repeatedly by quickly directing the electron beam back over the same points. This type of display is called refresh CRT. Generally, it is required to redraw 30 to 60 times in a second in order to avoid flicker. If the redraw is below 25 times per second than the picture flickers.

Different types of phosphors are available for use in CRT. Besides color, a major difference between phosphor is their persistence, i.e., how long they continue to emit light after the electron beam is removed. Persistence is defined as the time it takes emitted light to decay to one tenth of its original intensity. Lower persistence phosphor requires higher refresh rate to maintain a picture on the screen without flicker. A phosphor with low persistence is useful for animation, while high persistence phosphors are better suited for displaying highly complex, static pictures.

Deflection of the electron beam is done with electric field. The beam passes between two pairs of metal plates: one pair vertical, the other pair horizontal. A voltage difference is applied to each pair of plates according to the amount that the beam is to be deflected in each direction. As the electron beam passes between each pair of plates, it is bent towards the plate with the higher positive voltage.

In color screens, there are three guns, one for each color Red, Green and Blue (RGB). These cause each dot of the screen to generate red, green or blue light. The combination of these three give the full color spectrum. The computer directly controls the three guns. CRTs give a bright picture, with good colors but they are bulky and consume a relatively large amount of power.

Old monochrome models display text and graphics as either green on a black background or white on a black background. The foreground and background colors can be reversed by software. The monochrome monitors are gradually declining as most of the software developed these days uses many colors.

Flat Screens

Flat screen are slowly replacing the conventional CRT monitors, as they are bulky. These were introduced for use on battery-operated portable computers, as these consume very little power. Liquid Crystal Display (LCD) monitors use flat screen. In an LCD, the image is formed by so-called liquid crystals. These are long rod-like molecules which though solid can flow like a liquid.

Each pixel on the screen consists of a microscopic electrode positioned below several of these molecules. As the output from the computer scans the screen a row at a time, it activates each of these pixels in turn, switching it on or off. When a pixel is on, the crystals twist in such a way that they block out the light. When it is off, they let the light through.

Color LCDs require very fast liquid crystals. In what is called passive matrix display there are three screens, colored red, green and blue, which are placed on top of each other. Below the three screens are the thousands of pixel electrodes, which generate light. The pixels in each screen act as filters for this light. If a pixel is to be red, for example, the green and blue filters above it are turned on, blocking out those colors but the red filter is off, allowing the red light through. By turning the filters on and off in other combinations, other colors can be obtained. Active matrix screens are difficult to manufacture and are very expensive. They are available with only a few top-of-the-range computers.

Printers

Printers are used to produce hardcopy of computer output, normally data or text, but also in case of certain printers, graphics, that is, such as drawings or charts. Printers vary in their capabilities so far as text enhancements such as underlining or emboldening are concerned and also in their ability to print graphics.

Most printers are designed to receive data in parallel from the computer, i.e., 8 bits at a time. These have to be connected to the parallel port on the computer, also called LPT1 (short for Line Printer 1).

Computer printers differ in the following aspects:

- There are character printers, which print one character at a time, line printers, which print a line at a time, and page printers, which print a page at a time.

- A variety of printing technologies are possible, the main ones being dot matrix, daisy wheel, inkjet and laser.

- Some printers can only handle text whereas others can handle text and graphics.

- There are a variety of standards for control codes, which are commands, sent from the computer to the printer to turn on effects such as underlining and emboldening.

However most software packages are able to cope with these differences. They do so by means of printer drivers, special programs that adapt the output from the software to the printer. All you have to do is select your printer's name from the list that is presented to you when you first use the software.

The main types of printers are described below. The main differences between the printers depends on:

- The quality of output
- The ability to print graphics
- The printing speed

Character Printers

Character printers print one character at a time and hence they are slow printers. They are capable of printing at the rate of 30 to 300 characters per second (cps). The advantage of character printer is that they are low cost and are mainly used with personal computers. The disadvantage is, it is low speed and makes lot of noise while printing. Character printers were very popular in the past but these days they are being replaced with inkjet printers which have good printing quality, make less noise while printing, have fast printing speed and can produce multicolor printouts. Character printers are of two types, dot matrix printers and daisy wheel printers.

Dot Matrix Printers

Dot matrix printers normally have 9 or 24 pins arranged in the form of a matrix as shown in Fig.1.2. To print a character on the paper, the built-in microprocessor activates the appropriate pins in the print head to move forward and hit the printer ribbon, which is placed against a paper. As a result, the shape of the character appears on the paper. Dot matrix printers form the shape of characters by a number of dots and not with the character shape itself; therefore the print quality of these printers is low.

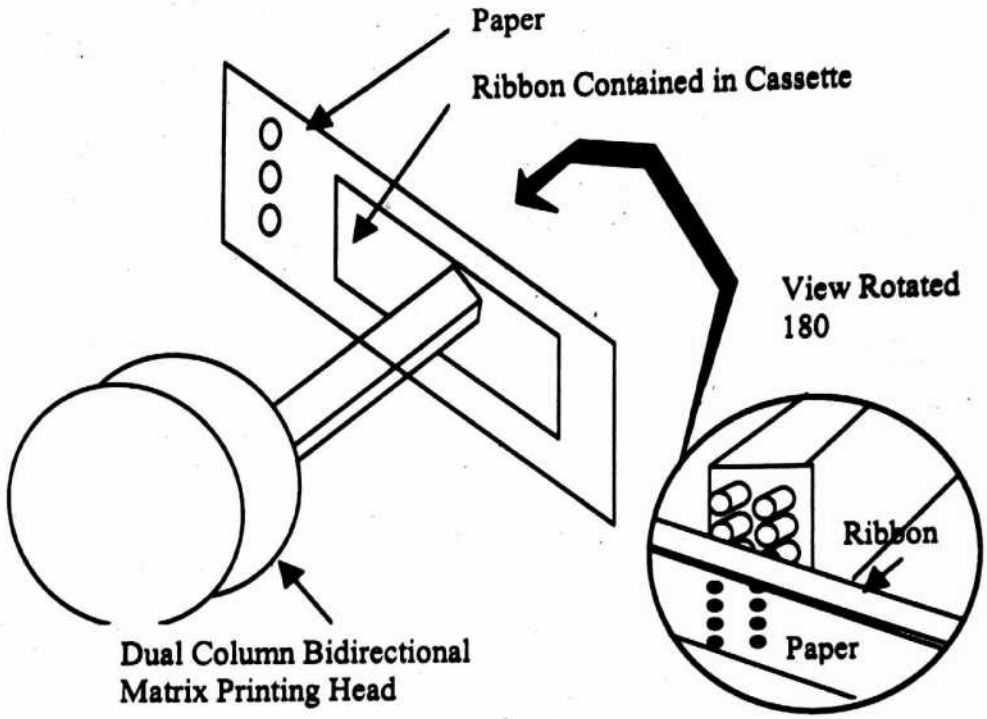

Fig.1.2. Dot matrix printing mechanism.

Daisy Wheel Printers

The print head of a daisy wheel printer is a circular wheel, about 3 inches in diameter with arms or spokes, illustrated in Fig.1.3. The character shapes are embossed at the outer end of the arms. The shape of printer wheel resembles the petals of a daisy flower and hence, it is named daisy wheel printer.

To print a character, the daisy wheel rotates so that the required character is positioned just in front of the printer ribbon. Now the spoke containing the required character is hit by a hammer and strikes the ribbon leaving an impression on the paper placed behind the ribbon. Movement of all these parts is controlled by microprocessor in the printer. The main advantage of using a daisy wheel printer is that the print quality is high because exact shape of the character hits the ribbon to leave an impression on paper.

Daisy Wheel Printers

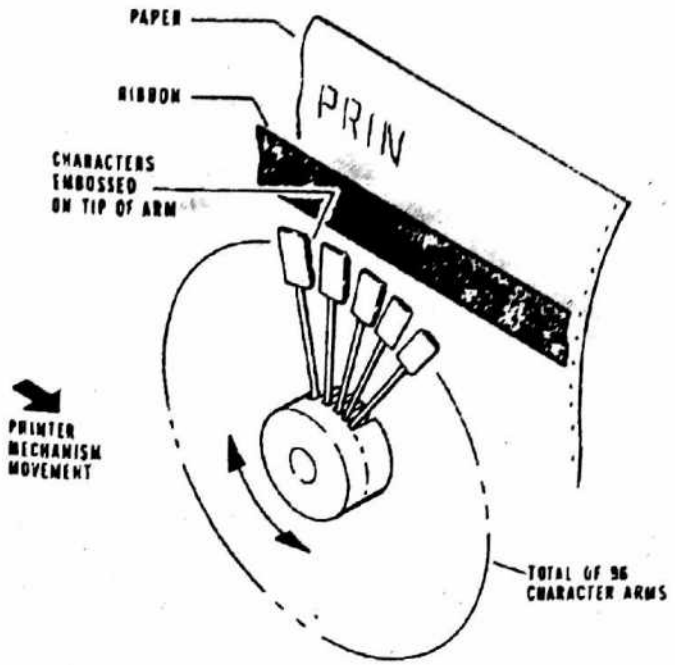

Fig.1.3. Daisy wheel print mechanism.

Line Printers

Line printers print one complete line a time and hence they are faster than character printers. Line printers are heavy-duty printers and they can print at the rate of 2000 lines per minute. Examples of line printers are chain printers and drum printer.

Chain Printer

Chain printer is illustrated in Fig.1.4. Print characters are contained in a chain, which is moved continuously at a rapid rate by two geared pulleys. Circuitry within the printer senses when the correct character appears at the desired print position on the page. At that point, a hammer strikes the page. This action presses the paper against a ribbon and against the character located at that position. The result leaves an impression of that character. As the chain continues to move transversely across the page, additional characters are printed as they reach the position required by the commands of the computer.

Chain Printer

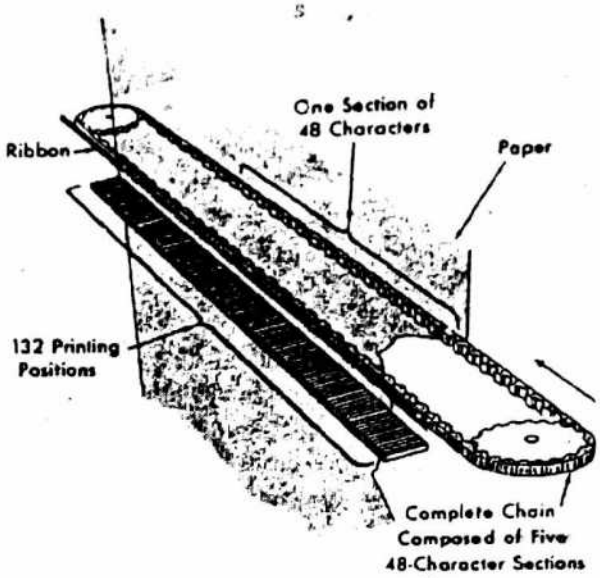

Fig.1.4. Printing mechanism of chain printer.

When the requirements of the printed line are fulfilled, the printer carriage control moves the page to the next line position.

The principal of the drum printer is illustrated in Fig.1.5, is very similar to that of the chain printer. All the characters in the specified character set are

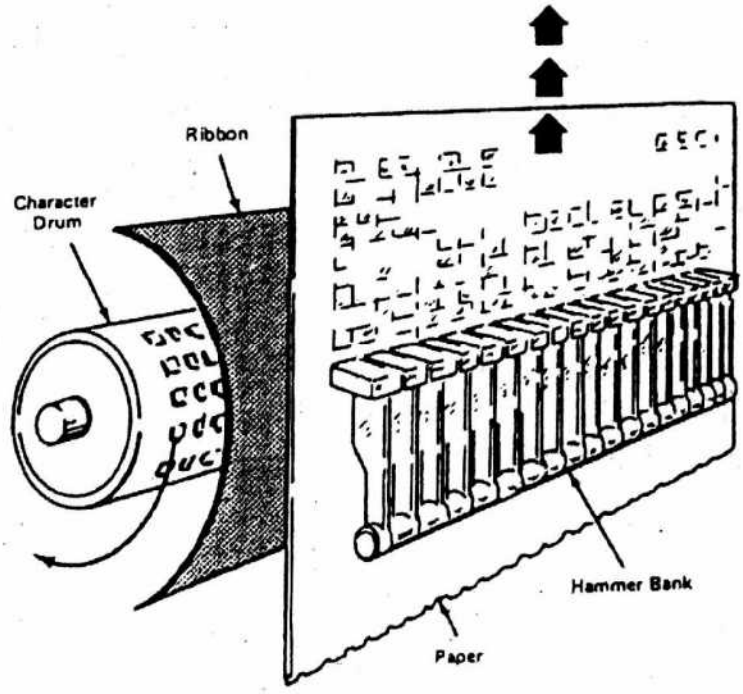

Fig.1.5. Printing mechanism of drum printer.

engraved along circumference of the drum and if 132 print positions are available, this is repeated for each column.

Character printers and line printers are called impact printers because they use electro-mechanical mechanism, which causes the character shape to strike against the paper and leave an image of the character on the paper.

Non-impact Printers

All the impact printers print slow due to the slow mechanical movement of the print head. Efforts were made to eliminate the mechanical motion of the print head to increase the speed of the printers and as a result non-impact high speed laser printers and ink jet printers were developed.

Laser printers are page printers, meaning that they print an entire page at a time. In fact they resemble photocopiers in size and appearance and employ a similar technology. They are very fast, typical speeds being around 8 pages per minute and virtually silent in operation. The print quality is good, almost equal to that of daisy wheel printers. The resolution of current models is 600 dots per inch (dpi), though some of the latest versions offer 1400 dpi. Laser printers can handle graphics as well as text.

They offer the quality of the daisy wheel with the versatility of the dot matrix while being faster and quieter than both. The print quality is higher than that of ink jet printers but they are more expensive.

The print mechanism in a laser printer consists of a laser light, roller and toner (ink) and works as follows: A sheet of paper is fed from a tray into the machine and receives an electrostatic charge across its surface. The laser beam then rapidly and invisibly traces the computer's output (text or graphics) as a pattern of tiny dots on the paper, during this process it removes the electrostatic charge from the points where the beam strikes the paper. The paper then receives a fine toner across its surface which adheres to the points with no charge but which is washed off the rest. After passing between rollers, the paper emerges, heated and dried at the front of the machine.

Plotters

A plotter is an output device used to produce hardcopy. Plotters are used for a variety of applications, which include drawing graphs, making maps, plotting civil engineering drawings and machine components. Plotters work on the principle of a human hand holding a pen and moving it on paper. Plotters are

normally very slow output devices because of excessive mechanical movement required during plotting but they still plot much faster than a draughtsman and the output is of better quality. Plotters are of two types flatbed and drum type.

Flatbed Plotter

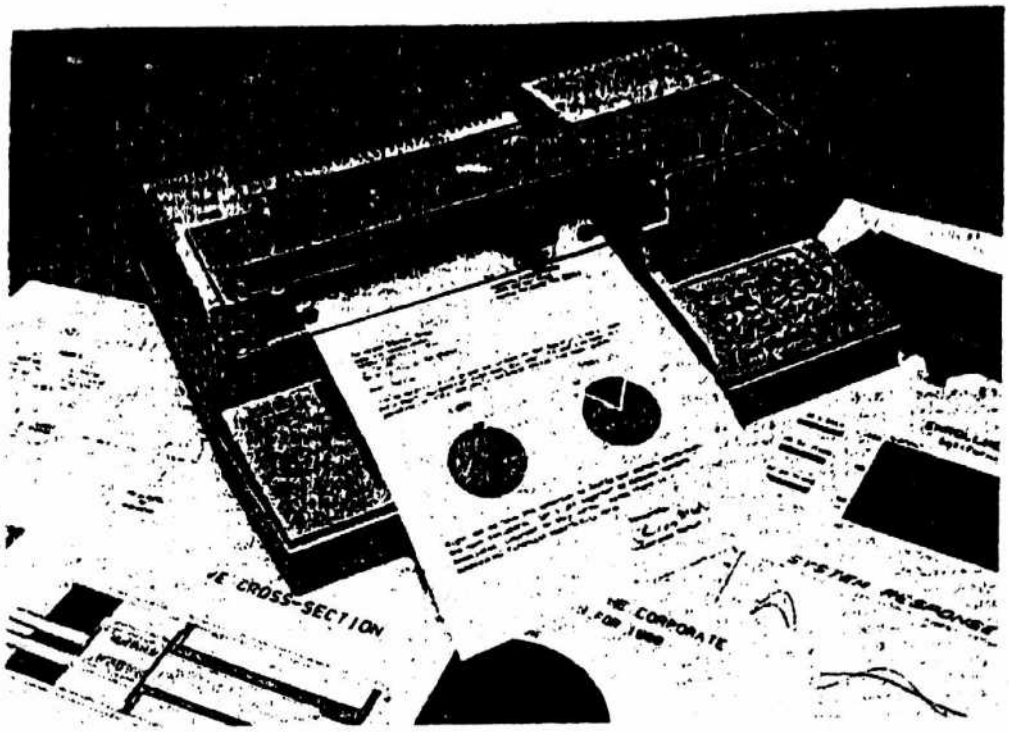

Fig.1.6. Flatbed plotter.

Flatbed plotter is less expensive and is used in many smaller computing systems. It plots on paper that is spread and fixed over a rectangular flatbed as shown in Fig.1.6. Pens of different colors are mounted in the pen holding mechanism that moves on the surface in two orthogonal directions. The pen can be raised or lowered onto the paper during the drawing operations. The microprocessor in the plotter selects the desired pen and controls its movement under the control of the computer.

Drum Plotter

Drum plotters are normally used with mainframe and minicomputer systems. The paper on which the design has to be made is placed over a drum that rotates back and forth to produce vertical motion. The pen is mounted on a carriage, which moves across the width of the paper. The vertical movement of the paper and the horizontal movement of the pen create the required design

under the control of the computer. Pen having ink of different colors can be used to produce output in multi-colors. The plot size may be very large with paper widths of up to 1 meter.

1.5 MEMORY

One of the major advantages that digital systems have over analog systems is the ability to easily store large quantities of digital information and data for short or long periods of time. This memory capability is what makes digital computer so versatile and adaptable to many situations. For example, in a digital computer the internal main memory stores instructions that tell the computer what to do under all possible circumstances so that the computer will do its job with a minimum amount of human intervention. Magnetic tape and magnetic disk are popular mass storage devices that are much less expensive in cost per bit than internal memory devices.

1.5.1 Memory Terminology

Memory Cell

This is a device or electrical circuit used to store a single bit (0 or 1).

Memory Word

This is a group of bits (cells) in a memory that represents information or data of some type. Word size in modern computers typically ranges from 4 to 64 bits, depending on the size of the computer.

Byte

This is a special term used for a 8-bit word. In modern digital computers, the word size is usually a multiple of 8-bits such as 2 bytes or 4 bytes.

Memory Capacity

This is a way of specifying how many bits can be stored in a particular memory device or complete memory system. To illustrate, suppose that we have a memory device, which can store 4096 20-bits words. This represents a total capacity of 81,920 bits. We could also express this memory's capacity as 4096 x 20. When expressed this way, the first number (4096) is the number of words and the second number (20) is the number of bits per word (word size).

Computer memory is measured in terms of bytes. The larger units are kilobyte, megabyte and gigabyte. The relationship between these units is shown below:

1 byte = 2^3 bits = 8 bits
1 kilobyte = 2^{10} bytes = 1024 bytes
1 megabyte = 2^{20} bytes = 1024 kilobytes = 1048576 bytes
1 gigabyte = 2^{30} bytes = 1024 megabytes = 1048576 kilobytes

Address

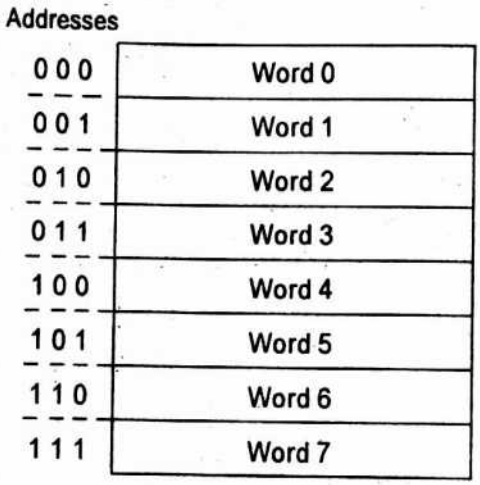

Fig.1.7. Memory words and addresses.

This is a number that identifies the location of a word in memory. Each word stored in a memory device or system has a unique address. Addresses are always specified as a binary number, although octal, hexadecimal and decimal numbers are often used for convenience. Fig.1.7 illustrates a small memory consisting of eight words. Each of these eight words has a specific address represented as a 3-bit number ranging from 000 to 111. Whenever we refer to a specific word location in memory, we use its address code to identify it.

Read Operation

This is the operation whereby the binary word stored in a specific memory location (address) is sensed and then transferred to another location. For example, if we want to use 'word 4' of the memory of Fig.1.7 for some purpose, we have to perform a read operation on address 100. The read operation is often called a fetch operation, since a word is being fetched from memory. We use both terms interchangeably.

Write Operation

This is the operation whereby a new word is placed into a particular memory location. It is also referred to as a store operation. Whenever a new word is written into a memory location, it replaces the word that was previously stored there. The old word is lost in the process of writing into this memory location.

Access Time

This is a measure of a memory device's operating speed. It is the amount of time required to perform a read operation. More specifically, it is the time between the memory receiving a read command signal and the data becoming available at the memory output.

Cycle Time

It is another measure of a memory device's speed. It is the amount of time required for the memory to perform a read or write operation and then return to its original state ready for the next operation. Cycle time is normally longer than access time.

Random Access Memory (RAM)

This refers to memories in which the actual physical location of a memory word has no effect on how long it takes to read from or write into that location. In other words, the access time is the same for any address in memory. Most semiconductor memories and magnetic disk memories are random access memories.

Sequential Access Memory

It is a type of memory in which the access time is not constant but varies depending on the address location. A particular stored word is found by sequencing through all address locations until the desired address is reached. This produces access times, which are much longer than those of random access memories. Examples of sequential access memory devices include magnetic tapes.

Read/Write Memory (RWM)

It is any memory that can be read from or written into with equal ease.

Read-Only Memory (ROM)

It refers to a broad class of semiconductor memories designed for applications where the ratio of read operation to write operations is very high. Technically, a ROM can be written into (programmed) only once and this operation is normally performed at the factory. Thereafter information can only be read from the memory. Other types of ROM are actually read-mostly memories (RMM) which can be written into more than once but the write operation is more complicated than the read operation. Therefore the write operation is not performed very often. RAM and ROM memory will be discussed in more detail in chapter 5.

Static Memory Devices

These are those semiconductor memory devices in which the stored data will remain permanently stored as long as power is supplied, without the need for periodically rewriting the data into memory.

Dynamic Memory Devices

These are those semiconductor memory devices in which the stored data will not remain permanently stored, even with power applied, unless the data is periodically rewritten into memory. This operation is called a refresh operation.

1.5.2 General Memory Operations

Although each type of memory is different in its internal operation, there are certain basic operating principles that are the same for all memory systems. Every memory system requires several different types of input and output lines to perform the following functions.

1. Select the address in memory that is being accessed for a read or write operation.
2. Select either a read or write operation to be performed.
3. Supply the input data to be stored in memory during a write operation.
4. Hold the output data coming from memory during a read operation.

5. Enable (or disable) the memory so that it will (or will not) respond to the address inputs and read/write command.

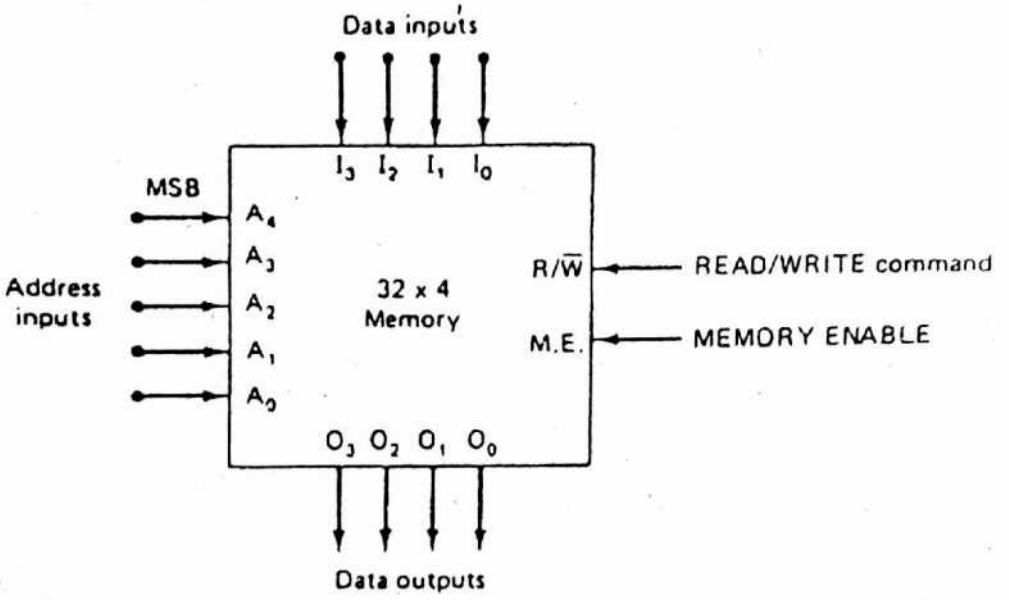

Fig.1.8. General diagram for a 32 x 4 memory.

Fig.1.8 illustrates these basic functions in a simplified diagram of a 32 x 4 memory that stores 32 4-bit words. Since the word size is 4 bits, there are four data input lines, I_0-I_3 and four data output lines O_0-O_3. During a write operation the data to be stored into memory have to be applied to the data input lines. During a read operation the word being read from memory appears at the data output lines.

This memory has 32 different storage locations and therefore 32 different addresses, ranging from 00000_2 to 11111_2 (0 to 31 in decimal). Thus, we need five address inputs, A_0-A_4, to specify one of the 32 address locations. To access one of the memory locations for a read or write operation, the 5-bit address code for that particular location has to be applied to the address inputs. The read/write input line determines which memory operation is to take place. Some memory systems use two separate inputs, one for read and one for write. When a single read/write input is used, it is common to use 1 for commanding a read operation and 0 commanding a write operation.

Many memory systems have some means for completely disabling all or part of the memory so that it will not respond to the other inputs. This is represented in Fig.1.8 as the memory enable input, although it can have

different names in the various memory systems. This type of input is useful when several memory modules are combined to form a larger memory.

1.6 INFORMATION SYSTEM DEVELOPMENT

Early information systems were designed to be operated by information professionals, and they frequently did not attain their stated social purpose. Modern information systems are increasingly used by persons who have little or no previous hands-on experience with information technology but who possess a much better perception about what this technology should accomplish in their professional and personal environments. A correct understanding of the requirements, preferences, and "information styles" of these end users is crucial to the design and success of today's information systems.

The principal objective of the systems analysis phase is the specification of what the system is required to do. In the systems design phase such specifications are converted to a hierarchy of increasingly detailed charts that define the data required and decompose the processes to be carried out on data to a level at which they can be expressed as instructions of a computer program. The systems development phase consists of writing and testing computer software and of developing data input and output forms and conventions. Systems implementation is the installation of a physical system and the activities it entails, such as the training of operators and users. Systems maintenance refers to the further evolution of the functions and structure of a system that results from changing requirements and technologies, experience with the system's use, and fine-tuning of its performance. Many information systems are implemented with generic, "off-the-shelf" software rather than with custom-built programs; versatile database management software and its nonprocedural programming languages fit the needs of small and large systems alike. The development of large systems that cannot use off-the-shelf software is an expensive, time-consuming, and complex undertaking. Prototyping, an interactive session in which users confirm a system's proposed functions and features early in the design stage, is a practice intended to raise the probability of success of such an undertaking. Some of the tools of computer-aided software engineering available to the systems analyst and designer verify the logic of systems design, automatically generate a program code from low-level specifications, and automatically produce software and system specifications. The eventual goal of information systems engineering is to develop software that use natural language and artificial intelligence

techniques as part of an integrated set of tools to support the analysis and design of large information systems.

1.7 SUMMARY

INTRODUCTION TO INFORMATION TECHNOLOGY

Information technology is concerned with the use of modern technology to aid in storage, processing, analysis and communication of information. Information can be stored in the computer in four different forms, that is, data, text, image and voice.

The IT Revolution

Information Technology is based upon the microprocessor. A microprocessor is a single IC chip that performs all the processing on data and controls the operation of the entire computer system. Modern digital computers are very powerful electronic machines and have the capabilities to handle data in graphics and speech forms also. Today's microcomputers are very small, very cheap, very reliable and very powerful.

Since the first IC chips were made in early 1960s, their power has increased every year while their cost has decreased and this has caused the information revolution.

COMPUTER HARDWARE AND SOFTWARE

Computer hardware consists of the physical components of the computer. This includes the memory, input/output devices, central processing unit (CPU) and the circuitry linking these devices with strands of parallel wires called buses.

Computer software consists of computer programs. A computer program is a sequence of instruction written in a programming language to solve a problem.

Firmware is an intermediate form between hardware and software. It is software permanently stored in IC chips during their manufacture.

TYPES OF SOFTWARE

Computer software is of two types, that is, system software and application software.

System software is designed to make the use of the computer more effective, efficient and user-friendly. It consists of a collection of operative programs.

Application software is written to solve various user problems. It includes application packages such as word-processing, spreadsheet, database management system, business graphics and communication software.

INPUT AND OUTPUT DEVICES

Input and output devices are used to communication with the computer.

Input devices are used to enter data and instructions (program) into the computer. These include keyboard, mouse, microphone, video cameras and scanners. Input devices convert information in any form (data, text, voice or image) into binary pulses recognized by the computer.

Output devices are used to communicate the solutions of problems to the human beings. They convert the results produced by the computer from binary form into human readable form so that human beings can understand them. These include monitors, printers and plotters.

MEMORY

A remarkable characteristic of digital computer is its ability to store information. Computer memory is classified into two major categories, short-term memory and long-term memory.

Short-term memory, also known as main memory is used to store instructions that the computer is to execute (that is a program) and data that is to be operated upon. It also stores the results of operations performed bye the ALU. It consists of semiconductor IC chip memory.

Long-term memory is used to store information permanently. It is also known as secondary or auxiliary storage. It consists of magnetic disks, magnetic tapes and Compact Disks.

A memory cell is an electronic circuit in an IC chip that is used to store a single bit (0 or 1). A group of bits (cells) that represent data or information of some type is known as memory word. Word size is usually a multiple of bytes and a byte is a group of 8 bits.

Memory address is a number that identifies the location of a word in memory. Each word stored in memory has a unique address.

Two types of operations are performed on any type of memory, that is, read and write operations. During a read operation, a word in a particular memory location if fetched and transferred to another part of the computer. During a write operation, a word is placed into a particular memory location. It is also called store operation. When a new word is stored into a memory word, previously stored word is automatically replaced at that memory location.

Random and Sequential Access Memory

In random access memory, the access time is the same for any memory location. Semiconductor IC chips and magnetic disks are random access memory.

In sequential access memory a particular memory word is accessed from the memory by going through all address locations until the desired address is found. Magnetic tapes are sequential access devices.

General Memory Operations

There are a large number of memory devices but only read or write operations can be performed on any type of memory. First, a memory address is selected for a read or write operation. Secondly, a read or write operation is selected to be performed. During a read operation, the output data comes from the selected memory location and during a write operation the input data is stored in the selected memory location.

INFORMATION SYSTEM DEVELOPMENT

Modern information systems are designed to be used by people who have very little or no previous experience with information technology.

Information system development can be divided into five phases as given below.

System Analysis: This phase is concerned with the specifications of what the system is required to achieve.

System Design: In this phase, specifications are converted into detailed charts that define the data required and express the processing to be carried out on data as instructions of a computer program.

System Development: This phase is concerned with the writing and testing of computer software and developing data input and output forms.

System Implementation: It is the installation of a physical system and training of operators and users.

System Maintenance: If refers to the necessary changes to be made in the system that result from changing requirements, technologies and experience with system's use.

1.8 EXERCISE

1. Fill in the blansk.

   i) Modern electronics is based upon the .....
   ii) ..... means software embedded in electronic devices during their manufacture.
   iii) ..... software enables us to do things that we bought our computer for.
   iv) OCR stands for .....
   v) ..... printer is a character printer.
   vi) ..... is used to produce hardcopy of graphs, maps and engineering drawings.
   vii) Electronic circuit used to store a bit is called .....
   viii) A number that identifies the location of a word in memory is called .....

2. What is the role of microprocessor in IT revolution?

3. Distinguish between computer hardware and software.

4. Write short noted on the following.
   a) The Keyboard b) The mouse c) The microphone.
   d) The monitor e) Cathode ray tube

5. Distinguish between the following.
   a) Random access memory and sequential access memory.
   b) Static memory devices and dynamic memory devices.

6. Define the following terms.
   a) Memory word b) Read and write operations
   c) Memory address d) Memory access time and cycle time

7. Explain information system analysis, development, implementation and maintenance.

8. What is printer? Briefly explain its types.

CHAPTER 2

COMPUTER NETWORKS

2.1 INTRODUCTION TO COMPUTER NETWORKS

Due to the tremendous impact of computers and computer networks on society during the past two decades, this period in history has come to be called the information age. The productivity and profitability of both organizations and individuals have been significant by these revolutionary tools. Individuals use computer networks almost daily to conduct personal and professional business. This trend is accelerating as more people discover the power of computers and communication networks both for businesses and for homes. The day-to-day transactions at department stores, banks, reservation counters and other businesses are all dependent upon computer networks. The information age is equally dependent on the computer and computer network.

A computer network is an interconnection between two or more computers so that they can communicate with each other. A network is made up of collection of computers and the connections between them that allow information exchange to take place. While most networks connect computers using some form of cable, the connections can also be wireless, for example radio waves.

Networks consist of computers and other devices, the physical connections between them and the additional hardware and software required to enable them to communicate with each other.

On a network, computers usually play one of two roles. They either offer resources for other computers to use or they access resources that have been shared by other computers. If a computer on the network shares resources for others to use, it is called a server. If a computer on the network accesses resources that are shared by other computers, it is called a client computer or simply client.

In theory there is no difference between a server and a client. Only their roles on the network differ. In practice, however, servers are often more powerful computers with faster processors, more memory and more disk space because

of the extra demands placed on them by multiple users. A server must provide service to many users on the network.

2.2 DEDICATED SERVER NETWORKS

In many computer networks, there is a clear distinction between server computers and client computers. Each computer on the network acts as either a server or a client. This type of network is called a dedicated server network and each server computer on the network is called a dedicated server. Servers are not used as client computers. Fig.2.1 illustrates how a dedicated server network may be designed. The computer at the top of the figure is the dedicated server, sharing printers, files and applications. The remaining computers in the illustration are clients that access resources shared by the server. Similarly, in a dedicated server network, client computers never act as servers.

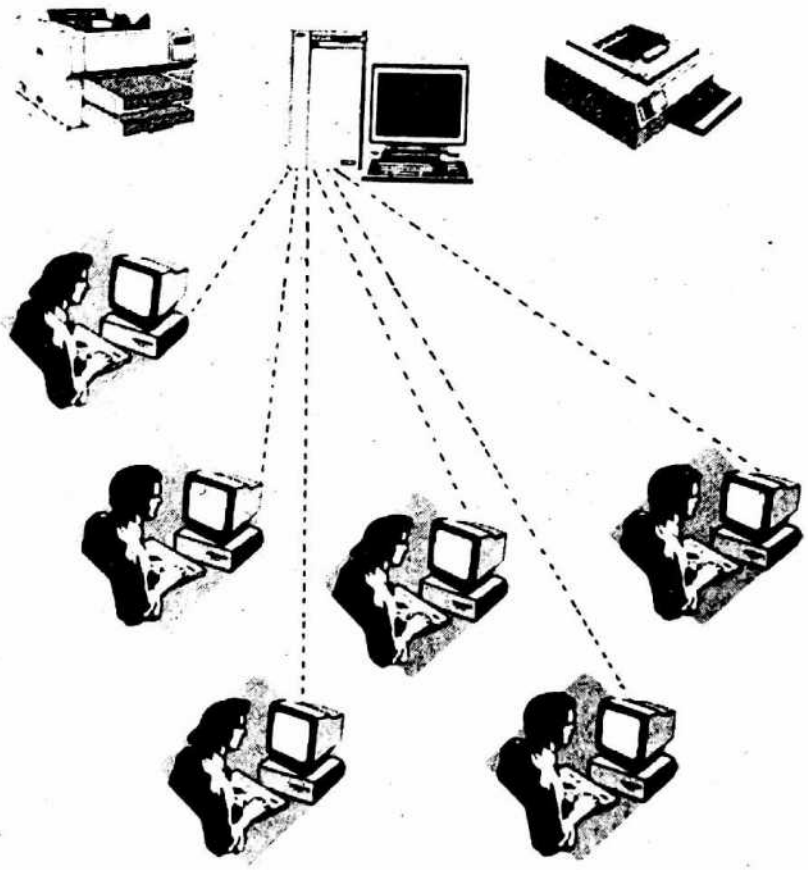

Fig. 2.1 A Dedicated Server Network

A dedicated server network includes one or more computers that are dedicated to acting as servers. The servers are optimized to provide quick access to shared network resources. Dedicated servers also provide centralized security to ensure that resources are not accessed by unauthorized users.

Because the dedicated server approach centralizes control of data and other shared resources, one person or group is typically responsible for administering the network.

Dedicated server networks tend to be big networks. They can be as small as two computers, but can support hundred or even thousands of users. Dedicated server network operating system software provides the capacity and tools to manage huge collection of computers. As a network increases in both size and traffic, you can add more servers to handle the extra load. Spreading many tasks across different server computers can balance the load and improve overall network performance.

2.3 PEER-TO-PEER NETWORKS

Some networks don't distinguish between servers and clients at all. In these networks, every computer is capable of playing the role of client, server or both at the same time. This type of network is called peer-to-peer network and each computer on the network is referred to as peer. In a peer-to-peer network, a peer computer acts as both a server and a client at the same time. So the peer computer on your desktop can share files and printers with other computers and it can simultaneously access other shared resources on the network. Fig.2.2 shows a conceptual view of a peer-to-peer network.

For example, if your manager has a laser printer attached to the computer in her office, her computer acts as a server when it shares the printer over the network for your group to use. On the same computer, your manager may frequently access files that are shared by her assistant's computer. In this situation, your manager's computer acts as a client when she accesses this shared information. So her computer acts as both a server and a client, depending on the task it is performing. She does not have to reboot the computer to change the role. This is the essence of peer-to-peer networking.

In a typical peer-to-peer network, no single person is assigned to administer the resources of the entire network. Because each user's computer is a server, individual users completely control which resources their computers share

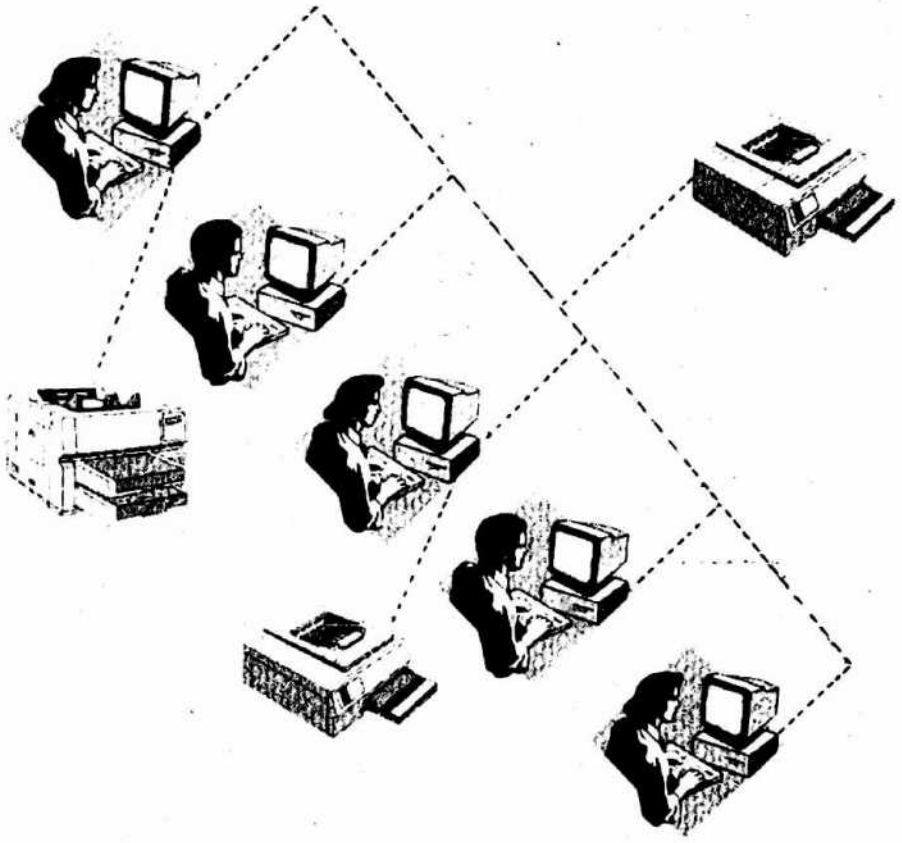

Fig. 2.2 A Peer-to-Peer Network

with the rest of the network. Users are responsible for making shared resources available, maintaining applications and data on their own computers, installing and upgrading applications and deciding who gets access to their shared resources. Individual users control their own security policies, selecting and assigning passwords to individual resources they share with others. .

Peer-to-peer networks tend to be relatively small. Most of these networks fall to range between two and ten computers. Large peer-to-peer networks become difficult to manage, because so many network administrators control sharing and maintaining shared resources. Networks of more than ten computers typically use a dedicated server approach or they combine peer-to-peer and dedicated server approach.

2.4 NETWORKING SOFTWARE

Computer networks require a combination of both hardware and software. Once you have your network in place, you need a Network Operating System or NOS to make it all work. A NOS is an operating system with built-in networking features. Some examples of NOS are Windows 98, Windows 2000 and Windows NT. The NOS provides all the features required to communicate over the network with other computers, to access network resources and to share them.

As your network grows in the number of computers, users and shared resources, the complexity of planning and maintaining your network increases quickly. Keeping track of user accounts, passwords and the physical locations of computers, printers and shared information can become a difficult task. Fortunately, the same software that makes basic networking possible, also provides the tools you need to handle these network management tasks.

2.5 LOCAL AREA AND WIDE AREA NETWORKS

Local Area Networks

You can find several different types of computer networks in use today, depending primarily on the size of the physical area they cover. The most common type of network is the Local Area Network or LAN. It is a network that spans a limited physical area, usually ranging from a small office to a campus of buildings. A LAN typically uses high-speed wired connections between the computers.

LANs emerged in the early days of personal computers and were originally designed to share expensive printers and hard disks within an organization. Since then, organizations have started sharing other devices including modems and scanners. LANs are also used today for sharing applications, group scheduling, e-mail, project tracking and other tasks.

Wide Area Networks

When a network covers a larger area, making it impractical to wire computers together with high-speed communication lines, it becomes a Wide Area Network or WAN. A WAN spans a large physical area, connecting several sites of an organization across cities, countries and continents. Because of the

longer distances involved, WANs are sometimes referred to as long-haul networks.

In theory, the concepts and purposes of WANs are identical to those of LANs. In practice WANs typically rely on slower long-distance connections between sites and use leased lines or even satellite links.

A WAN is often made up of two or more LANs connected together. For example, you might have a LAN at each site of your organization and each of those LANs might be connected together to form a WAN.

2.6 PURPOSE OF NETWORKS

File Sharing

The most important use of networks is sharing data files. One approach to sharing files involves placing the file in a shared location on one computer and making it available to other computers. Other users who want access to the file can either open the shared copy directly or copy it over the network to their own local hard disks.

Printer Sharing

High-end printers are relatively expensive devices. As a result, sharing printers became a primary use of networks. To share a printer, you physically connect the printer to a computer acting as a server. Using the NOS, you share the printer over the network. Users can then print to your shared printer as easily as if the printer were directly connected to their own local PCs.

Hard Disk Sharing

When large hard disks were relatively expensive devices, network users attached them to servers and shared them over the networks. Users could access the contents of one or more hard disks or store and retrieve their own data in a directory on the server's hard disk. A single hard disk might accommodate many users, each with his own private directory. This approach kept the cost of individual PCs lower and the extra cost of server hardware was spread across many users.

Application Sharing

Application sharing is nothing more than file sharing where the files just happen to be the executable application files themselves. Instead of installing and running an application on a local hard disk, you place the application once on a server. Users then load and run the application over the network. Keep in mind that not all software vendors design their applications to run in this type of shared environment.

Remote Access

The use of networking allows a very flexible working environment. Employees can work at home by using terminal connected through networks into the computer at the office. Many employees now carry terminals or portable personal computers on trips and connect into their networks through hotel room telephones. Other employees travel to remote offices and use telephones and networks to transmit and receive critical sales, administrative and research data from computers at company headquarters.

2.7 BENEFITS OF NETWORKING

The benefits of networking in organizations include increased productivity, lowered costs, smaller storage requirements and reduced efforts.

Increasing Productivity

Just as standalone PCs can increase user productivity, networks of PCs enhance that productivity even further. Users can share, access, view and modify information anywhere on the network without leaving their desks. Users don't have to carry floppy disks from one place to another, wait to print out information they want to share and become distracted from their normal work flow.

Saving Money

Sharing expensive devices such as printers, plotters, scanners and large hard disks over a network can save money. The most obvious thing of these savings is the total purchase price. Fewer expensive devices also mean fewer maintenance contracts, service calls and upgrade costs.

Saving Disk Space

Sharing software applications can generate savings in several ways. Perhaps the most obvious is in the cost of the software itself. Most networked versions of applications cost less per user than purchasing individual copies for each user. You can also realize savings in your total disk space requirements. If nearly everyone in your organization uses a word processing program, you may not have to consume all that space on every computer. Instead, install the software only once on a server computer and let everyone access that single copy.

Saving Efforts

Another benefit of application sharing involves the time saved during software installation and configuration. If you install the software only once on a server and configure it in a standard way, you will spend much less time than if you had to install it on multiple client computers.

2.8 WORKGROUP COMPUTING AND GROUPWARE

A workgroup is a collection of individuals working on a task. Workgroup computing occurs when all the individuals have computers connected to a network that allows them to send e-mail to one another, share data files and schedule meetings.

Groupware is the software that supports workgroup computing. It provides facilities to collaborate among users on both local area and wide area networks.

Groupware includes following types of software.

1. E-mail is where groupware begins. After basic printer and file sharing, electronic messaging is the networking product that people encounter and increasing rely on. Modern e-mail programs do more than simply send messages. Most leading e-mail packages have the ability to easily transmit formatted files, voice, annotations, animations and other attachments.

   At the core of any e-mail or groupware application is a database that manages users and files and an internal messaging facilities that lets

application components communicate with one another. For groupware applications to work smoothly in a collaborative environment, they should all support the same messaging and directory standards.

2. Scheduling and contact-management groupware lets users share and update group schedules across networks.

3. Document-sharing and document management groupware involve the online creation, sharing, editing and distribution of documents, from letters to business forms. These programs let you easily see changes made by others and some groupware allows two or more people to work on the same document at the same time.

4. Teleconferencing software combines audio, video application-sharing and shared electronic chalkboards in collaborative computing.

2.9 NETWORK TOPOLOGIES

Networks require both network adaptor hardware in each device to be connected and some physical (or wireless) connection to hook them all together. The arrangement of network nodes and connections between them is called the network's topology. A node represents a computer. Topology is simply a map of the layout of nodes and connections in the network. Three network topologies are popular today, namely, bus, star and ring.

Bus Topology

In a bus network topology, you connect each node to the network along a single piece of network cable, called a bus. The bus provides the path for the data and devices tap into the bus along its length to communicate with other devices. As shown in Fig.2.3, network nodes essentially tap into the bus at convenient locations along the way. Data travels from a node out onto the bus until it reaches the ends of the cable. At each end of the bus, a device called a terminator is installed to prevent data signals from reflecting back onto the bus and causing errors. A terminator is a special resistor device that is attached to an electrical ground.

Bus topology is suitable for small networks. If the single cable acting as the bus is severed at any point, the entire network can go down. Although it is the

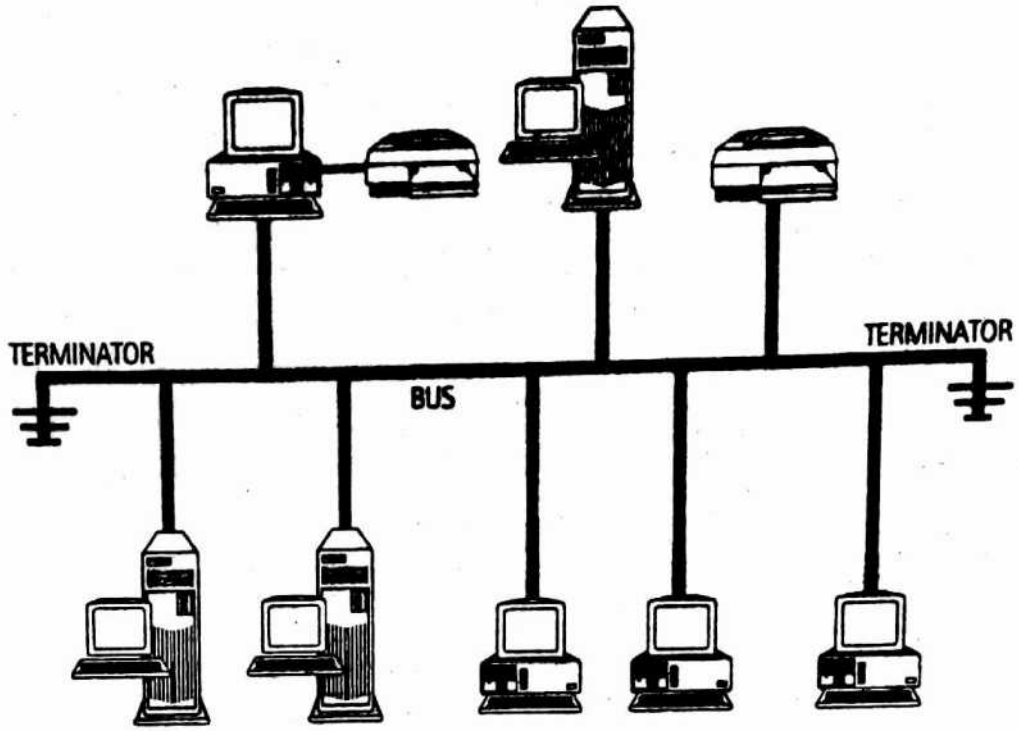

Fig. 2.3 The Bus Network Topology.

lowest cost topology to implement, it is recommended for small networks in the same room where the network cabling is easily accessible.

Star Topology

In the star network topology, you connect each network node to a central device called a hub. Small LANs with less than eight nodes usually need only one hub. Larger networks can require many hubs and hubs can be connected to each other to tie all the nodes together into a single network.

Hubs typically allow four, eight or sixteen nodes before another hub is required. In Fig.2.4, for example, the upper hub uses seven of its eight connections for attaching nodes and its eighth to connect to the other hub. This approach of connecting stars together is also sometimes used when setting up a WAN. If two branch offices each have their own star topology LANs, you can connect the two LANs together by connecting the two hubs together via a WAN connection.

Star topologies are more expensive to implement than bus topologies. You must invest in at least one hub, even if you want to connect only two

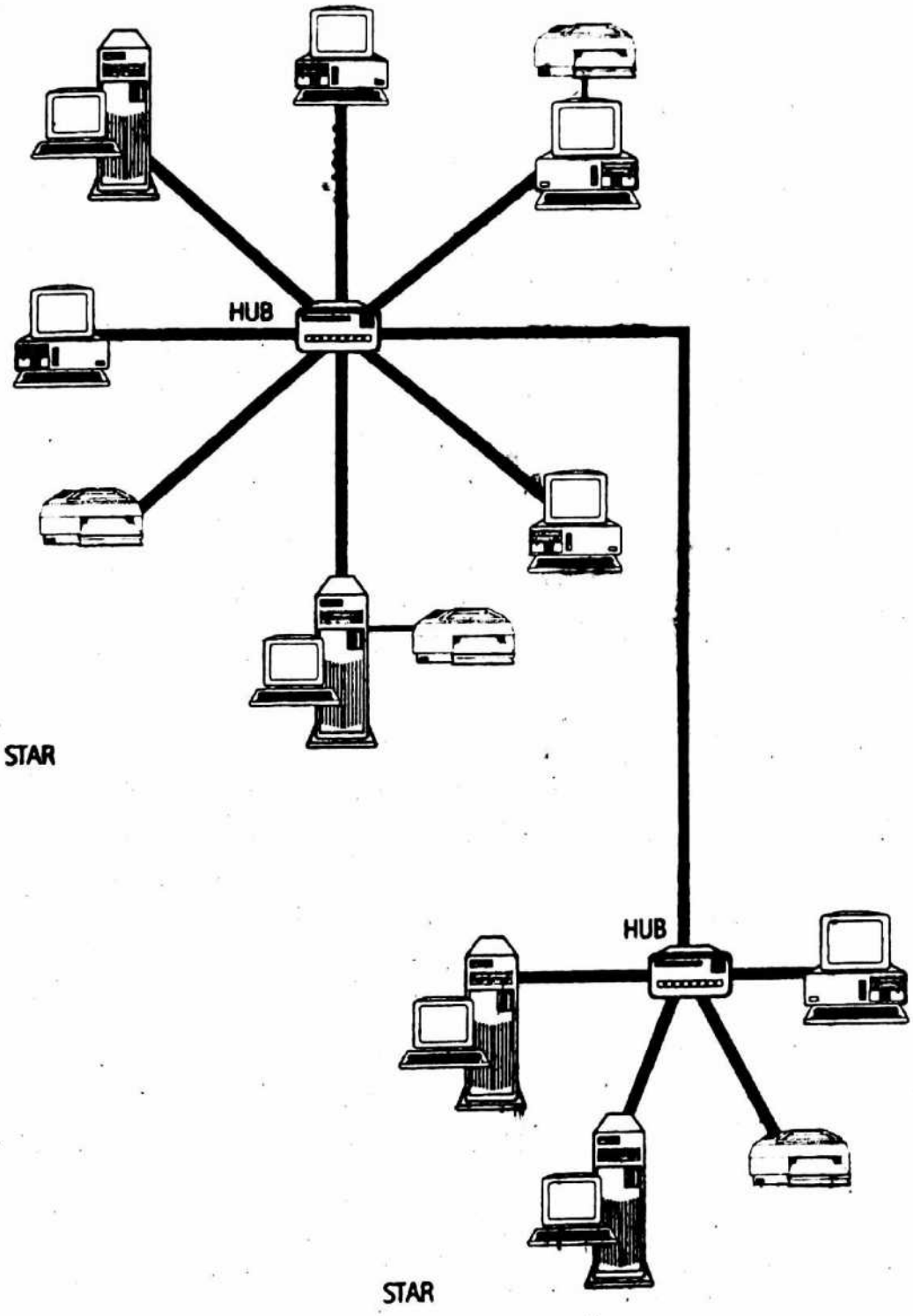

Fig. 2.4 The Star Network Topology.

computers together. Each addition of four, eight or sixteen nodes to the network may require an additional hub. In contrast, bus topologies require no

additional external hardware. beyond the inexpensive terminators at each end of the bus.

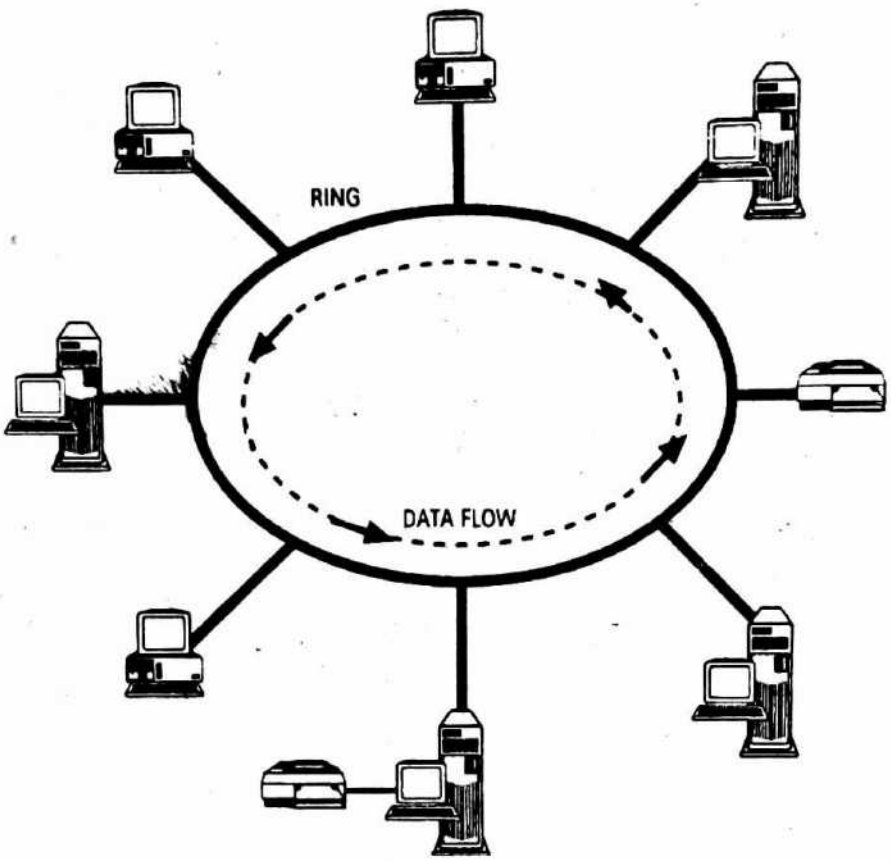

Fig. 2.5 The Ring Topology.

Ring Topology

The ring network topology is shaped just like a ring. It is made up of an unbroken circle of network nodes. Essentially, each node is directly connected to its two immediate neighbors. Data on the network flows in one direction around the ring, traveling from one node to the next along the way. Fig.2.5 illustrates the ring topology.

Conceptually, a ring is like a hub with its two ends brought together. In other words, a ring is like a circular bus, to which all nodes are directly attached. The ring topology may face reliability problems because it depends on an

unbroken link between each adjacent node on the network. If the ring is broken at any point along the way, the entire network stops functioning.

2.10 ISO AND OSI MODEL

The International Standards Organization (ISO), based in Geneva, developed standards for international and national data communications. The U.S. representative to the ISO is the American National Standards Institute, or ANSI. In the early 1970s, the ISO developed a standard model of a data communication system and called it the Open Systems Interconnection (OSI) model.

The OSI model, consisting of seven layers, describes what happens when a terminal talks to a computer or when one computer talks to another. This model was designed to facilitate creating a system in which equipment from different vendors can communicate.

Other data communication models are IBM's System Network Architecture (SNA) and Digital Equipment Corp.'s DEC Network Architecture (DNA), both of which predate the OSI model.

The OSI Layer Cake

Think of the OSI model as a layer cake like the one shown in Fig.2.6. At the bottom, holding everything else up, is the Physical layer, which is made up of the wiring or cables.

These are the layers of the OSI model:

7. *Application layer*: At this level, software follows standard for look and feel.

6. *Presentation layer*: Here, data is formatted for viewing and for use on specific equipment.

5. *Session layer*: This layer provides a standard way to move data between application programs.

4. *Transport layer*: Transport layer software provides for reliable and transparent transfer of packets between stations.

3. *Network layer*: Software operating at this layer provides an interface between the Physical and Data-link layers and the higher-level software, which establishes and maintains connections.

2. *Data-link layer*: This layer provides for the reliable transfer of information across the Physical layer. It synchronizes the blocks of data, recognizes errors and controls the flow of data.

1. *Physical layer*: The most important layer is concerned with transmitting a stream of data over the physical cables and wires. Hardware and software operating at this level deal with the types of connectors, signaling and media-sharing schemes used on the network.

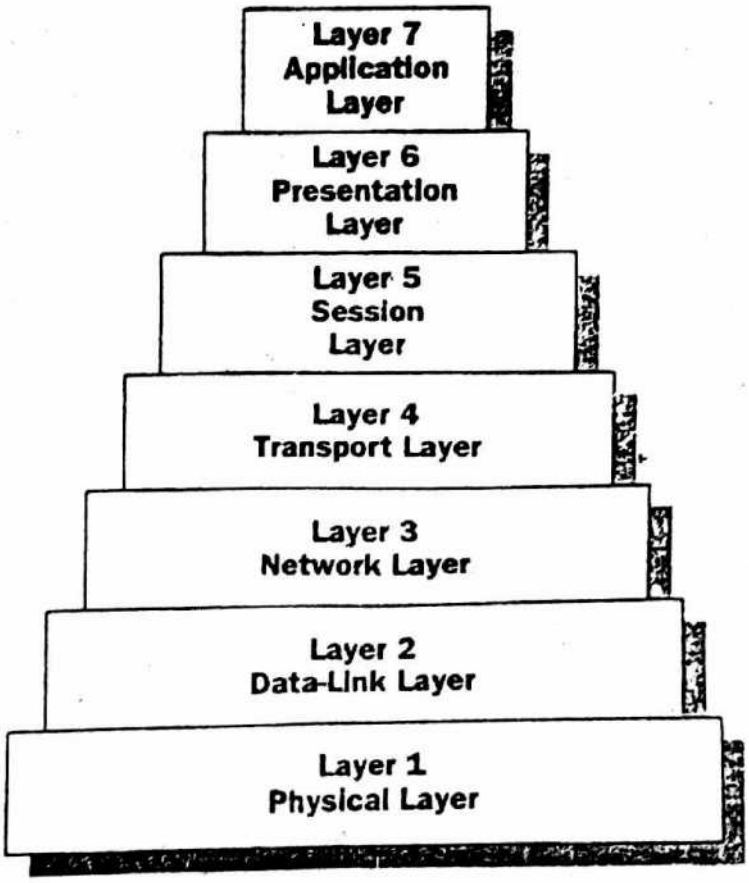

Fig.2.6. Layers of OSI model.

The Physical Layer

The Physical layer furnishes electrical connections and signaling. Subsequent layers talk through this Physical layer. Twisted-pair wiring, fiber-optics strands and coaxial are all part of the Physical layer.

The most common standard in the Physical layer is RS-232, a wiring and signaling standard that defines which pin on the connectors does what and when a voltage level on a wire represent a 1 or a 0. Europeans use an international standard called V.24 which is lot like RS-232. All of these are Physical layer standards.

The Physical layer carries the signals for all the higher layers. Pull the plug and you won't communicate at all. But without higher layers, you won't have anything to say. The higher you go in the OSI model, the more meaningful the communication is to the end user.

The Data-Link Layer

Once you have made the physical and electrical connections, you must control the data stream between your system and the one at the other end. The Data-link layer of the OSI model works like the overseer of a railroad yard that is putting cars together to make up a train. This functional level strings characters together into messages and then checks them before putting them on the track.

The Network Layer

Large wide area networks typically offer a number of ways to move a string of characters put together by the Data-link layer from one geographic point to another. The third layer of the OSI model, the Network layer, decides which physical path-way the data should take, based on network conditions, priority of service and other factors.

The Network layer software usually resides in switches out on the network and the network card inside your PC must put the data together in a way the network software can recognize and use in routing.

Once there were many important products in the Network layer from companies like IBM and Digital but this area is about conformity and

performance not about variety and choices. Today, the Internet Protocol (IP) has won the Network layer competition. Most modern networks depend on the details of IP to address, route and handle their packages of data. You will find IP teamed with its Transport layer, TCP and with other products in the large TCP/IP family.

The Transport Layer

The Transport layer of OSI model does many of the same jobs as the Network layer but it does them locally. Drivers in the networking software perform the Transport layer's task. This layer is the railroad yard dispatcher who takes over if there is a wreck out in the system. If the network goes down, the Transport layer software looks for alternative routes or perhaps saves the transmitted data until the network connection is reestablished. It handles quality control by making sure that the data received is in the right format and in the right order. This formatting and ordering capability becomes important when Transport layer programs implement connections among dissimilar computers. Whereas the Data-link layer counts boxcars to see if they are all there, the Transport layer opens them up to see if anything is missing or broken.

Networks of dissimilar computers can use several Transport layer protocols. One of the most common is the Transmission Control Protocol (TCP), developed by the Department of Defense and now adopted and marketed by many companies as the part of the TCP/IP protocol suite.

The Session Layer

Layer 5, the Session layer, is often very important in PC-based systems. It performs the function that enables two applications or two pieces of the same application to communicate across the network, performing security, name recognition, logging, administration and other similar functions.

The Presentation Layer

As soon as you see blinking characters, reverse video, special data-entry formats, graphics and other features on the screen, you are in the Presentation Layer. This layer might also handle encryption and some special file formatting. It formats screens and files so that the final product looks the way the programmer intended.

The Hypertext Transfer Protocol (HTTP), used to format the information contained on web sites is an excellent example of a Presentation Layer protocol. Presentation Layer software also controls printers, plotters and other peripherals. Microsoft Windows performs many presentation layer functions.

The Application Layer

The top of the layer cake is the Application Layer and it serves the user. It's where the network operating system and application programs reside, performing everything from file sharing, print-job spooling and electronic mail to database management and accounting. The standards for this top layer are new. In a way this layer is the most important one because the user controls it directly.

2.11 PROTOCOLS

Protocols represent an agreement among different parts of the network i.e. how data is to be transferred. Though you are not supposed to see them and only a few people understand them, their effect on system performance can be spectacular. A poorly implemented protocol can slower data transfer but software following standard protocols can make communications between dissimilar systems possible. For instance, the TCP/IP protocol enables you to transfer data between computers that have different architectures and operating systems.

The key elements of protocol are syntax, semantics and timing. The syntax specifies the signal levels to be used and the format in which the data is to be sent. Semantics specifies the information structure needed for coordination among machines and for data handling. Timing includes speed matching so that a computer with a 33.6 kilobit per second port can talk to one with a 56 kilobit per second port and the proper sequencing of data in case it arrives out of order.

IEEE 802.X Standards

The Institute of Electrical and Electronics Engineers (IEEE) has developed a set of standards describing the cabling, physical topology, electrical topology and access scheme of network products. The committee structure of the IEEE is numbered like the decimal system. The general committee working on these

standards is 802. Various subcommittees. designed by decimal numbers. have worked on different versions of the standards.

These standards describe the protocols used in the lower two layers of the OSI model, the Physical and Data-link layers. They don't go above those layers

IEEE 802.3 and 802.5

IEEE standard 802.5 describes the Token-Ring architecture. The work of this committee received a lot of attention and leadership from IBM. This standard describes a token-passing protocol used on a network of stations connected in a special way, combining an electrical ring topology where every station actively passes information to the next one in the ring.

IBM's Token-Ring system is important to corporate data processing managers because IBM supports a number of mainframe computers Token-Ring interfaces.

Many vendors make Token-Ring interface cards for popular minicomputers. These allow easy interaction without the use of complex and expensive micro-to-mainframe links and gateways.

IEEE 802.3, on the other hand, describes a standard that owes a lot to the earlier Ethernet system. It uses Carrier Sense Multiple Access (CSMA) signaling on an electrical bus topology. The standard leaves room for several wiring options. One extension to the 802.3 standards introduced signaling at 100 megabits per second under what is commonly called Fast Ethernet or the 100 Base-T standard. You can buy 802.3 interface cards for the PC from dozens of manufacturers. Similar cards designed for popular minicomputers are also widely available.

IEEE 802.6

Metropolitan-Area Networks or MANs make up the 802.6 sub-category of the IEEE 802 standards project. Metropolitan networks can take many forms but the term usually describes a backbone network of fiber-optic cables that could span hundreds of square miles. The telephone companies provide a great deal of MAN connections, as do a growing number of cable television companies. While some organizations install their own microwave systems for MAN circuits, the majority lease circuits from local telephone companies or cable television companies

TCP/IP

The earliest large network systems were fielded by the Department of Defense (DoD). The DoD financed the development of interactive network communications software for many different mainframes and minicomputers. The standard core of the DoD specified software consists of programs that implement two protocols, that is, Transmission Control Protocol (TCP) and Internet Protocol (IP). The availability of TCP/IP software and the power of the biggest TCP/IP application, the Internet make them attractive to face the challenge of integrating dissimilar computer systems. TCP/IP software is popular on large networks because it works and is available for practically in all computers.

TCP and IP perform primarily what the OSI model terms layer-3 (Network) and layer-4 (Transport) functions. Particularly important is the capability to communicate and to order data among two or more different computer systems.

Companies like Net Manage and Walker Richer and Quinn sell TCP/IP software customized for specific computers and controller cards. These software modules communicate through the network, recognize each other and pass messages in common format generated by the higher-level Session layer and application programs. TCP/IP software is popular on large networks because it works and is available for practically in all computers.

X.25 Protocol

X.25 protocol defines how communication devices such as routers package and route data over a connecting circuit. X.25 data packaging and routing can be used over any satellite or Integrated Services Digital Network (ISDN) communication circuits. It can also be used over any type of point-to-point circuits but the protocol is better known for its packet-switching capabilities.

There are two main types of Public Data Networks (PDN), circuit switched and packet switched each with its own standards. Since the Public Switched Telephone Network (PSTN) is still widely used for data communication, standards have been established for interfacing to this type of network. In general, the standards for each of these networks refer to the lowest three layers of the OSI model. Let us outline the differences between the two types of switching used in PDNs.

Circuit Switched Network

Each connection through a circuit switched network results in a physical communication channel being set up through the network from the calling to the called subscriber equipment. This connection is used exclusively by the two subscribers for the duration of the call. An example of a circuit switched network is the telephone network.

In the context of data transmission, a feature of a circuit switched connection is that it effectively provides a fixed data rate channel at which both subscribers must operate. Also, before any data can be transmitted over such a connection, a connection must be set up or established through the network. Currently, the time required to set up a call through the telephone network can be relatively long, owing to the type of equipment used in each exchange. Normally, therefore, when transmitting data, a connection is established and kept open for the duration of the communication. However, the widespread introduction of new computer-controlled switching exchanges, couples with the adoption of digital transmission throughout the network, means that the setup time of a connection through the telephone network is rapidly becoming much shorter. Furthermore, the extension of digital transmission to the subscriber's computer means that a high rate switched transmission path will be available for data transmission. This path then can be used for transmitting data without using modems. The resulting digital Public Switched Telephone Network (PSTN) can also be regarded as a Circuit Switched Data Network (CSDN) or Integrated Services Digital Network (ISDN) since such networks can support both digitized voice and data.

Although the connection setup time associated with an all-digital circuit switched network is relatively fast, the resulting connection still provides only a path with a fixed data rate for both transmission and reception.

Packed Switched Network

In packet switched network, two communication subscribers can operate at different data rates, since the rate at which data is passed at two interfaces to the network is separately regulated by each subscriber's equipment. Also, no physical connections are established through the network with a packet switched network. Instead, all data to be transmitted is first assembled into one or more message units, called packets. These packets include both the source and destination network addresses. They are then passed by the source computer to its local Packet Switching Exchange (PSE). On receipt of each

packet. the exchange first stores the packet and then inspects the destination address it contains. Each PSE contains a routing directory specifying the outgoing links' transmission paths to be used for each network address. The PSE forwards the packet on the appropriate link at the maximum available bit rate. This mode is often referred to as packet store-and-forward.

A number of packets may arrive simultaneously at a PSE on different incoming links and each may require forwarding on the same outgoing link. If a number of particularly long packets are waiting to be transmitted on the same link. other packets may experience unpredictable long delays. To prevent this and to ensure that the network has a reliably fast transit time. a maximum length is allowed for each packet. These packets are reassembled into a single message by the corresponding transport protocol at the destination.

X.25 protocol describes a method of encapsulating and handling packets with high reliability. Several companies manage networks of special computerized switches spread across the nation and across the world that connect together with high-speed data communication lines and use X.25. These companies sell their networks' data handling and transmission capabilities to subscribers under several pricing schemes. National telephone companies in many countries offer X.25 services. sometimes at lower rates than leased line or dial-up lines.

X.25 packet-switching networks provide effective solutions for many applications where high reliability and low delay are required and where multiple users need to connect to multiple host for short periods of time.

A perfect example of an X.25 network application is the processing of credit-card charges you see in stores daily. The electronic transaction from the card reader is frequently carried over an X.25 network. Short messages which include your account number. store identification and the amount of the charge can go to the proper clearing house or bank. X.25 network enables this to occur without the use of costly. dedicated connections from each store to each bank that issues credit cards.

2. 12 SUMMARY

INTRODUCTION TO COMPUTER NETWORKS

A computer network can be defined as a system composed of two or more computers that can communicate with each other through a communication line. A computer that shares resources for others to use on the network is called a server and a computer that accesses the resources that are shared is called client computer or simply client. Based on how information is shared on the network, they are classified into dedicated server networks and peer-to-peer networks.

DEDICATED SERVER NETWORK

In a dedicated server network, one or more computers are dedicated to act as servers and provide quick access to shared resources. Dedicated server networks provide centralized control of data, other shared resources and centralized security to ensure that resources are not accessed by unauthorized users.

PEER-TO-PEER NETWORK

In a peer-to-peer network, every computer can act as a client, server or both at the same time. In this type of network, each computer is referred to as peer or peer computer. So each peer computer can share files and printers with other computers and it can also access other shared resources on the network. Large peer-to-peer networks become difficult to manage because so many network administrators control sharing and maintaining shared resources.

NETWORK SOFTWARE

A Network Operating System (NOS) is required to make a network work. A NOS is an operating system that provides all the features required to communicate over the network with other computers.

LOCAL AREA AND WIDE AREA NETWORKS

Based on the physical distance between the computers. computer networks are divided into two categories. Local Area Network (LAN) and Wide Area Network (WAN).

A LAN interconnects computers. terminals and peripheral devices within a geographical area such as office building or a university campus and provides high-speed communication.

A WAN interconnects widely separated computers and terminals together and it may operate nationwide or worldwide. Normally public transmission media such as telephone lines. coaxial cables or fiber optics are used in WANs.

PURPOSE OF NETWORKS

Networks are used for sharing resources and communication. The resources that are shared over networks include files. printers. hard disk and application software. Networks also provide the facility of remote access..

BENEFITS OF NETWORKING

Networks increase the productivity. Sharing expensive devices such as printers can save money. You can also save disk space by installing a software once on a server and allow others to use that single copy. You save time and efforts when you install and configure a software only once on a server because installing it on multiple computers requires more time and efforts.

WORKGROUP COMPUTING AND GROUPWARE

A workgroup is a collection of individuals working on a task on a network and groupware is the software that supports workgroup computing. Groupware includes E-mail programs. scheduling and contact management groupware. document sharing and management groupware and teleconferencing software.

NETWORK TOPOLOGIES

A network configuration or the way in which the end-points or nodes of a network are interconnected is called network topology. It is the shape or physical connectivity of the network. Three types of network topologies are commonly used namely bus, star and ring.

ISO AND OSI MODEL

ISO stands for International Standards Organization that developed standards for international and national data communications.

In early 1970s, ISO developed a standard model of a data communication system called Open System Interconnection (OSI) to facilitate a communication system in which equipment from different vendors can communicate with each other. It consists of seven layers that describe how a computer can talk to another computer over a network.

PROTOCOLS

A network protocol is a language and set of rules that nodes agree to use to communicate over the network. Many different network protocols exist at all layers of OSI model. Windows includes support for several industry standard protocols and it lets you install other protocols supplied by third parties. If you need to, you can run more than one protocol on a node at the same time, even on a single network adaptor.

2.13 EXERCISE

1. Fill in the blanks.
   i) A ..... is an interconnection between two or more computers so that they can communicate with each other.
   ii) A ..... network provides centralized security to ensure that resources are not accessed by unauthorized users.
   iii) In a ..... network, every computer is capable of playing the role of client, server or both at the same time.
   iv) A ..... spans a large physical area, connecting several sites of an organization across cities, countries and continents.

v) ..... is the software that supports workgroup computing.

vi) The network configuration or the way in which the nodes of a network are interconnected is called .....

vii) A network ..... is a language and set of rules that nodes agree to use to communicate over a network.

viii) The ..... layer of OSI model decides which physical path-way the data should take based on network conditions.

2. What is a computer network? Explain.

3. Distinguish between dedicated server networks and peer-to-peer networks.

4. Distinguish between LAN and WAN.

5. Explain the purpose of networking.

6. Explain the benefits of networking.

7. Define network topology and briefly explain its types.

8. Explain TCP/IP protocol.

9. Explain circuit switching and packet switching techniques used in data communication.

CHAPTER 3

DATA COMMUNICATION

3.1 INTRODUCTION TO DATA COMMUNICATION

The recent merger of telecommunication and computers is a significant technological event. As a result, we are able to transport the computer's power from special computer rooms to remote locations. Most of the microcomputers, minicomputers and mainframes sold have the communication capabilities. The data processing and communication industries have become closely integrated bringing computing power to all parts of the business and commercial world.

Basic Elements of a Data Communication System

Data communication is the process of transferring information from one point to another. Data communication consists of three basic elements, which are:

1. A transmitter, which is the source of information or from where the information is sent.

2. A medium, which carries the information such as telephone lines, coaxial cables, fiber optics, etc.

3. A receiver, which receives the information.

The transmitter and receiver are normally computer devices such as computers, terminals, printers, etc. The electronic systems that transfer data from one place to another are called data communication systems.

3.2 DATA COMMUNICATION MODES

The mode of transmission used depends upon the type of terminal used in the data communication network and the speed at which the data must be transmitted. There are three modes of transmission.

Simplex

A simple line is capable of transmitting data in only one direction. The reason is not due to any property of the wires themselves but simply because one end has only transmitter and the other has only receiver. In modern data communication, this configuration is normally not used because it provides no way for the receiver to transmit an acknowledgement signal to the sender, indicating that the message was received correctly. Radio and television broadcasting are examples of simplex transmission. Simplex communication is seldom used in data communication because a return path is generally needed to send acknowledgement, error or control signals.

Half-Duplex

A half-duplex line can send and receive data in both directions but not simultaneously. During any transmission, one modem is the transmitter and the other is receiver. This type of transmission is typically found in transaction-oriented systems where the terminal operator would enter data and then receive a response from the computer system. In this case, the data entered by the terminal operator would be going in one direction on the line and the computer system could not communicate with the terminal when the data is being entered. When the computer system responds to the terminal, the operator cannot enter data. When the half-duplex lines are used, the transmission flow is reversed. This requires a small amount of time, which is approximately 150 milliseconds. With high-speed communication capabilities of computers the time required to reverse the flow of transmission is not acceptable in many instances.

Full Duplex

A full-duplex line can send and receive data in both directions simultaneously. A full-duplex line is equal to two simplex lines one in each direction. Because two transmissions may be proceeding in parallel, one in each direction, a full-duplex line can transmit more information than a half-duplex line of the same data rate. Furthermore, full-duplex lines do not waste any time in switching directions and this improves efficiency. Also some applications require simultaneous transmission in both directions.

3.3 DATA COMMUNICATION USING TELEPHONE LINES

In a local network, it is feasible to connect the computers and terminals by simply connecting wires or coaxial cables between them. In a wide area network, however, the cost of doing so is almost prohibitive. Moreover, in countries where the telephone company enjoys a monopoly, it is also illegal. As a result, it is usually necessary to use the existing telephone network for communication purposes. The telephone networks were designed for transmitting the human voice, not digital data, but they can be used to transmit digital data if the number of bits per second is sufficiently low.

The maximum number of bits per second that can be transmitted over a given channel (telephone line, radio transmission, etc.) is a characteristic of the channel. The noise level of the channel imposes the limitation. If an attempt is made to transmit more bits per second then the channel is capable of transmitting, some information will be lost, that is errors will occur. What happens is that, as the bit rate increases, the error rate also increases. Above a certain error rate, a channel may be unacceptable. Telephone lines are rarely used at bit rates exceeding 56,000 bps. In contrast, most tape drives can transmit information to main memory at a rate exceeding 1,000,000 bps.

To transmit digital information over an analog line, each second is divided into n indivisible time intervals. During each interval, one or more bits can be transmitted. For example, if the computer could set the line to 1, 2, 3 or 4 volts during any time interval, those four voltages could be used to represent 00, 01, 10 or 11, thus allowing 2 bits to be sent per time interval. An n-baud line is one in which the signal can change n times per second, that is, n intervals per second. If each change has four possibilities, as in the preceding example, the transmission is called dibit and the bit rate is twice the baud rate.

Modulation

Information entering or leaving a digital computer is in binary form. The voltage on an input line takes only two values as shown in Fig.3.1(a). Two-level signals suffer considerable distortion when transmitted over a voice-grade telephone line, thereby leading to transmission errors.

Because the pulsations of a sine wave are completely predictable, a pure sine wave transmits no information at all. However, by varying the amplitude, frequency or phase, a sequence of 1s and 0s can be transmitted as shown in Fig.3.1. This process is called modulation. In amplitude modulation

(Fig.3.1(b)), two different voltage levels are used, for 0 and 1. A person listening to digital data transmitted at a very low data rate would hear a loud noise for a 1 and no noise for a 0.

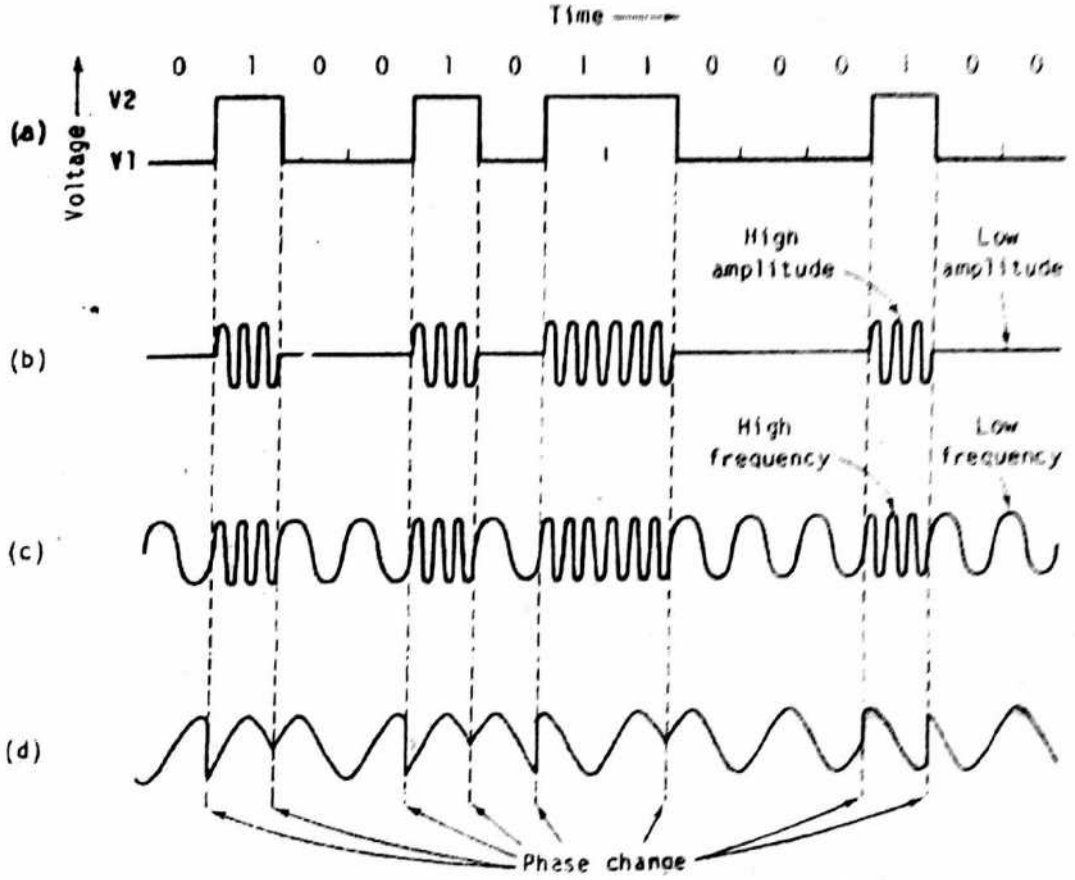

Fig.3.1 Bit by bit transmission over a telephone line.

In frequency modulation (Fig.3.1(c)), the voltage level is constant but the carrier frequency is different for 1 and 0. A person listening to frequency modulated digital data would hear two tones, corresponding to 0 and 1. Frequency modulation is often referred to as frequency shift keying.

In simple phase modulation (Fig.3.1(d)), the amplitude and frequency do not change but the phase of the carrier is reversed 180 degrees when the data switches from 0 to 1 or 1 to 0. In more sophisticated phase-modulated systems, at the start of each indivisible time interval, the phase of the carrier is abruptly shifted by 45, 135, 225 or 315 degrees, to allow 2 bits per time interval. Dibits phase encoding is one of the most commonly used methods at speeds above 300 pbs, for reasons of cost and reliability.

If the data to be transmitted consists of a series of 8-bits characters, it would be desirable to have a connection capable of transmitting 8 bits simultaneously, that is, eight pairs of wire. Because voice-grade telephone lines provide only one channel, the bits must be sent serially one after another or in groups of two bits if dibit modulation is being used. A device that accepts characters from a computer in the form of two-level signals, one bit at a time and transmits the bits in groups of one or two, in amplitude, frequency or phase-modulated form, is called a modem (modulator-demodulator)

The transmitting modem sends the individual bits within one character at regularly spaced time intervals. A second modem at the receiving end is used to convert a modulated carrier to a binary number. Because the bits arrive at the receiver at regularly spaced intervals. Once the receiving modem has determined the start of the character, its clock tells it when to sample the line to read the values of the individual bits.

3.4 ASYNCHRONOUS AND SYNCHRONOUS TRANSMISSIONS

Two different methods are used for transmitting characters. In asynchronous transmission, the time interval between two characters is not fixed, although the time interval between two consecutive bits within a character is fixed. For example, a person typing at a time-sharing terminal will not type at uniform speed, so the time interval between two consecutive characters will not be constant.

This speed variation raises the problem of how the receiver can recognize the first bit of a character. If the modulation methods of Fig.3.1 are used, there is no way to distinguish between no data and a 0 bit. A character consisting entirely of 0s would be completely invisible. Furthermore, a character consisting of a 1 followed by seven 0s could not be distinguished from a character consisting of 7 0s followed by a 1, because the receiver would have no way of recognizing the start of the character.

In order to permit the receiver to recognize the start of a character, a start bit is transmitted directly before each character. To improve reliability, 1 or 2 stop bits are transmitted directly after each character. Normally, the line is kept in the 1 state while no data is being transmitted to allow a broken circuit to be detected, so the start bit is 0. The stop bits are then 1 to distinguish them from start bits. Between the start and stop bits, the data bits are transmitted at uniformly spaced time intervals. A timer in the receiving modem is started

when the start bit arrives, allowing the modem to tell which bit is which. Asynchronous communication is illustrated in Fig.3.2(a).

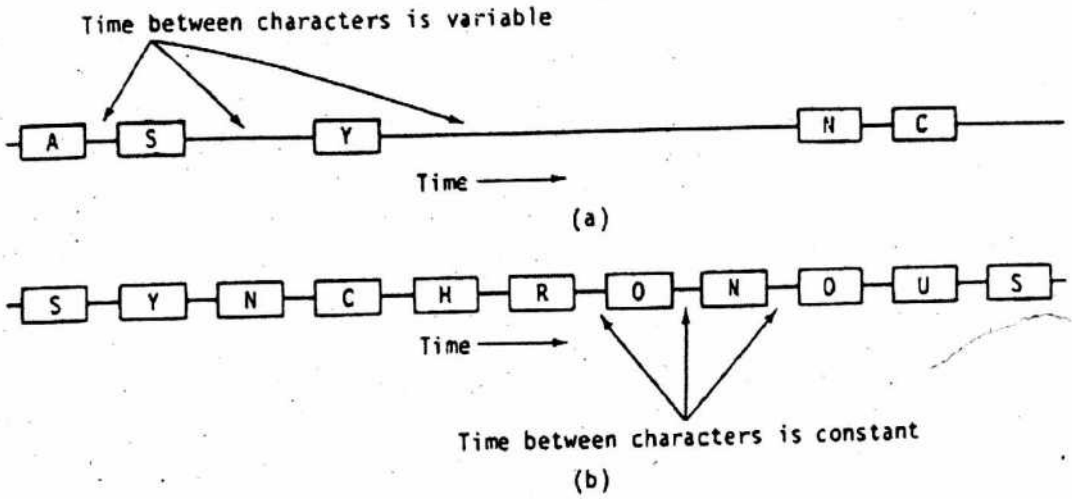

Fig.3.2 (a) Asynchronous transmission, (b) Synchronous transmission.

The most common bit rates used for asynchronous transmission are 110, 300, 600, 1200 and 2400 bps. A 7-bit ASCII character plus 1 start bit plus 1 parity bit plus 2 stop bits gives 11 bits per character. Therefore, 110 bps corresponds to 10 characters/sec.

In synchronous transmission, the need for non-information-carrying start and stop bits is eliminated. The result is to speed up data transmission. Synchronous communication often proceeds at bit rates of 4800 pbs, 9600 pbs or even higher. In this method, once the modems have synchronized, they continue to send characters in order to remain in synchronization, even if there are no data to transmit. A special "idle" character is sent when there is no data. In synchronous transmission, unlike asynchronous transmission, the interval between two characters is always exactly the same.

Synchronous transmission requires that the clock in the transmitter and receiver remain synchronized for long interval of time, whereas asynchronous transmission does not, because the start of each character is explicitly indicated by a start bit. Synchronous transmission is illustrated in Fig.3.2(b).

3.5 COMMUNICATION MEDIA

Data is transmitted from a terminal to a computer system or from the computer system to a terminal over communication lines (also called communication channels or communication media). The communication media includes the following types:

1) Standard telephone lines
2) Coaxial cables
3) Microwave transmission
4) Satellite Communications
5) Fiber optics

Telephone Lines

Standard telephone lines are widely used as communication lines. Telephone lines are particularly useful to the user of data communication because the complex network of lines that has already been established permits data to be transmitted to almost any location in the world.

Coaxial Cable

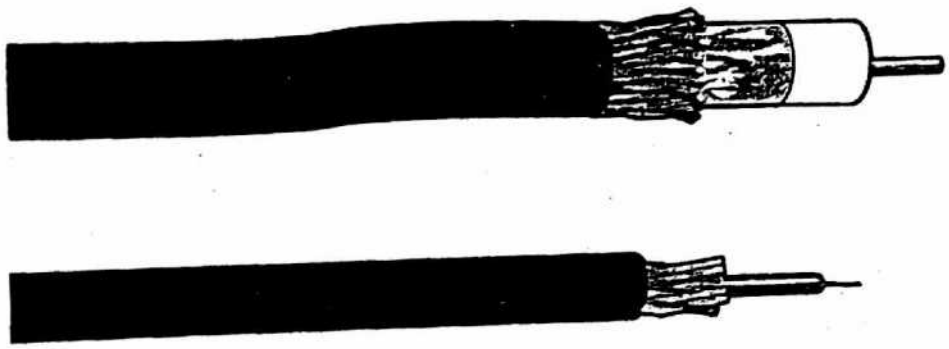

Fig.3.3 Thick and thin coaxial cables.

A coaxial cable can transmit information at much higher rate of 10 mega bits per second. It is mostly used for long distance transmission. They are also used by telephone companies to transmit data over long distance. Coaxial cables are packaged into a very large cable that can handle hundreds of

thousands of telephone calls simultaneously. They provide high quality data transmission without distortion or loss of signal. Coaxial cables have been laid under the ground or under the ocean. Both telephone lines and coaxial cables are usually made up of copper.

Microwave Transmission

Microwave transmission signals travel through open space much like radio signals. They provide a much faster transmission rate than is possible with either telephone lines or coaxial cables. Microwave systems transmit information with transmitters which are normally installed on high buildings, mountains tops or high towers. Long distance microwave channels consist of a series of relay stations (boosters) spaced approximately 30 miles apart. Two stations must be within sight of one another. For transmitting information long distances, signals are amplified and retransmitted from station to station.

Communication Satellites

Quickly gaining importance as a means for data communications are communication satellite systems. Positioned in space approximately 22,000 miles above the earth are a number of communication satellites. These satellites serve as relay stations for the transmission of signals generated from the earth.

Satellite communication is ideal for long distance communication. Earth stations consisting of ground antennas beam signals to the satellite. The satellite amplifies and retransmits the signals to another earth station which can be located many thousands of miles away. Transmission by satellite allows large amount of data to be sent long distance at rapid speeds. Its use has increased dramatically in recent years. However, a major drawback of satellite communication has been the high cost of placing the satellite into its orbits. These satellites are launched either by rockets or by space shuttles and precisely positioned in the space with an orbit speed that exactly matches with the rotation speed of the earth. Therefore, it is stationary relative to earth and always stays over the same point on the ground. This allows a ground station to aim its antenna at a fixed point in the sky.

Fiber Optics

Fiber optics is relatively new technology that may serve to replace conventional wire and cable in communication systems.

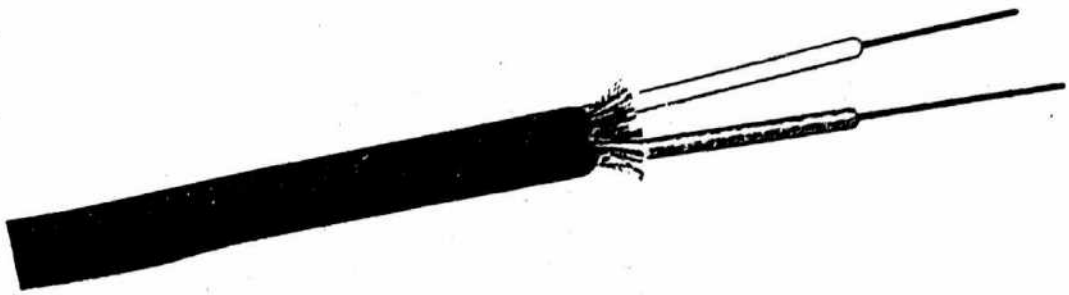

Fig.3.4 Fiber optic cable.

This technology is based upon the ability of smooth hair-thin strands of transparent material to conduct light with high speed. The major advantage of fiber optics over wire cables includes substantial weight and size savings and increased speed of transmission. A one and one-half pound fiber optic cable can transmit the same amount of data as thirty pounds of copper wire. A single fiber optic cable can carry up to 50,000 channels.

In fiber optics communication, the transmitter side has a converter that converts electrical signals into light waves and these are transmitted over the fiber optics. Another converter is placed at the receiving end that converts the light waves back to electrical signals.

Fiber optics provide high quality transmission at very high speed. Fiber optic transmission is not affected by electromagnetic interference. Hence noise and distortion are also reduced. Furthermore, they have the capabilities to transmit both analog or digital data. In analog transmission, the light intensity is varied continuously whereas in digital transmission the light source is turned on or off.

3.6 COMMUNICATION SPEED

Bandwidth describes the data communication capacity of a communication system. It is the range of frequencies available for the transmission of data. The wider the bandwidth of a communication system, the more data it can

transmit per second. Narrow bandwidth allows a limited data transmission rate whereas wider bandwidth allows more rapid flow of information.

The data communication speed is measured in a unit called baud. In general, baud is same as number of bits transmitted per second. However, as mentioned earlier, technically baud refers to the number of signal changes per second. In most of the communication systems, 1 baud represents only one signal change per second and hence is equivalent to 1 bit per second. But if dibit is used 1 baud can represent 2 bits per second.

Different grades of channels provide a variety of speeds in which data can be transmitted over the channels. The grades of channels are commonly classified into three categories.

Low Speed or Narrow Band

Low speed or narrow band has a bit transmission rate of 40 to 300 baud. In this category telegraph communication lines are included. These channels are usually used for low-speed teletypewriter communications and for other low-speed terminals.

Medium Speed or Voice Band

Medium speed lines operate at rates varying from 300 baud to 56,000 baud. This speed range is accommodated by lines which are used for ordinary voice communication hence the term "voice band" is used to describe these lines. The most commonly used media for this speed is telephone line.

Specific data transmission speeds are normally provided. Common speeds include 600, 1,200, 2,400, 4,800, 9,600, 14,400, 28,800 and 56,000 baud. At higher speeds, the lines must be specially conditioned by the addition of electronic components which minimize interference on the line and ensure that the data is sent on the line without error.

High Speed or Broadband or wideband,

High-speed communication channels, commonly called broadband or wideband, permit transmission rates over 56,000 baud. High speed channels require microwave, fiber optics or satellite transmission. They are normally used for computer-to-computer communication since computers usually send data to each other faster than terminals send data to computers. These systems

can provide data transmission rates of 1 million baud or more. Broadband is used when a large volume of data is to be transmitted at high speed.

3.7 SUMMARY

WHAT IS DATA COMMUNICATION?

Data communication is the process of transferring information from one point to another. It consists of a transmitter, from where the information is sent, a medium which carries the information such as telephone lines and a receiver which receives the information.

DATA COMMUNICATION MODES

There are three modes of data transmission which are simplex, half-duplex and full duplex.

A simplex line can transmit data in only one direction. It provides no way for the receiver to send an acknowledgement signal to the sender. Examples of simplex transmission are radio and television broadcast.

A half-duplex line can send and receive data in both directions but not simultaneously. When half-duplex lines are used, transmission flow is reversed. It is mainly used in transaction-oriented systems.

A full-duplex line can send and receive data in both directions simultaneously. Full-duplex line does not waste any time in switching directions and this improves efficiency.

DATA COMMUNICATION USING TELEPHONE LINES

Telephone lines were designed to transmit the human voice but they can be ·d to transmit digital data if the number of bits per second is sufficiently low. To transmit digital signals over the telephone lines which transmit analog signals, a device called modem is used. Modem is a device that accepts characters from a computer in the form of two-level signals one bit at a time and transmit the bits in amplitude, frequency or phase modulated forms. A modem is attached to a transmitter to convert binary signals into analog

signals for transmission on telephone lines. A second modem at the receiving end is used to convert the analog signals back to binary form. Therefore, information entering or leaving a digital computer is in binary form.

ASYNCHRONOUS AND SYNCHRONOUS TRANSMISSION

Asynchronous and synchronous are the two different methods used for transmitting characters.

In asynchronous transmission, the time interval between two characters is not fixed, although the time interval between two consecutive bits within a character is fixed.

In synchronous transmission, the time interval between two characters is always exactly the same. Synchronous transmission requires that the clock in the transmitter and receiver remain synchronized for long interval of time. A special "idle" character is sent when there is no data.

COMMUNICATION MEDIA

The communication media includes the following five types.

Telephone Lines: Telephone lines are widely used with modem as communication lines. The complex network of telephone lines provides the facility to transmit data to almost anywhere in the world.

Coaxial Cable: It is used to transmit data at much higher rates than telephone lines for long distance communication. Coaxial cables have been laid under the ground or under the ocean. It is made up of copper like the telephone lines.

Microwave Transmission: It is used for high speed transmission. Microwave systems transmit information with transmitters installed on high buildings, mountain tops or high towers.

Communication Satellites: These are mostly used for fast long distance communication. Satellites serve as relay stations for the transmission of signals generated from the earth.

Fiber Optics: This technology is based upon the ability of smooth hair-thin strands of transparent material to conduct light with high speed. In fiber optics transmission, the transmitter has converter that converts electrical signals into light waves for transmission over the fiber optics. Another converter placed at the receiving end converts the light waves back to electrical signals.

COMMUNICATION SPEED

Different types of communication lines provide a variety of speeds at which data can be transmitted. The grades of channels are commonly classified into following three categories.

Low Speed or Narrow Band: It has a bit transmission rate of 40 to 300 baud. These channels are used for low-speed teletypewriter communication.

Medium Speed or Voice Band: Medium speed lines operate at rates between 300 to 56,000 baud. The most commonly used media for this speed is telephone lines.

High Speed or Broadband: Broadband are the high speed communication channels. It can transmit data at rates over 56,000 baud. It requires microwave, fiber optics or satellite transmission. These are normally used for computer to computer communication.

3.8 EXERCISE

1. Fill in the blanks.
   i) The process of transferring information from one point to another is known as .....
   ii) A ..... line can send and receive data in both directions but not simultaneously.
   iii) Time interval between two characters in not fixed in ..... transmission.
   iv) In ..... transmission, start and stop bits are not required.
   v) Satellite serves as a ..... for transmission of signals generated from earth.
   vi) Transferring a sequence of 1s and 0s by varying the amplitude, frequency or phase is called .....
   vii) A device that converts digital signals to analog and analog to

digital for communication over a telephone line is called .....

viii) The data communication speed is measured in .....

2. Define data communication system and explain the functions of its basic elements.

3. Explain the three types of data communication modes.

4. What is meant by modulation? Explain how data can be transmitted over the telephone lines using amplitude, frequency and phase modulation.

5. Distinguish between asynchronous and synchronous transmission.

6. Explain the following types of communication media.
   i) Microwave ii) Satellite iii) Fiber optics

7. Define data communication speed, explain how it is measured and briefly explain narrow band, voice band and broadband.

CHAPTER 4

APPLICATION AND USE OF COMPUTERS

In general, human beings can do whatever computers can do but computers can do it with much greater speed and accuracy. This is in spite of the fact that computers perform all their calculations and operations one step at a time. For example, a human being can take a list of 10 numbers and find their sum all in one operation by listing the numbers one over the other and adding them column by column. A computer, on the other hand, can add numbers only two at a time. so adding this same list of numbers will take nine actual addition steps. Of course, the fact that the computer requires only a nanosecond or less per ster, makes up for this apparent inefficiency.

A computer is faster and more accurate than people but unlike most people it has to be given a complete set of instructions that tell it exactly what to do at each step of operation. This set of instructions, called a program, is prepared by one or more persons for each job, the computer has to do. These programs are placed in the computer's memory unit in binary-coded form, with each instruction having a unique code. The computer takes these instruction codes from the memory one at a time and performs the operation called for by this code.

Computers have found their way into application areas that were not feasible 20 years ago. The rapid increase in the number and variety of computer applications has made them a significant part of our lives. The following sections present examples from some of the major areas of application.

4.1 EDUCATION

The use of computer in education started in the 1970s, with the introduction of microcomputers. The use of computers has become widespread from primary education through the university level. A large variety of tutorial programs are available for teaching various topics to students. When a tutorial program is used, the student is asked a question by the computer, the student types an answer and then gets an immediate response to the answer. If the answer is correct, the student is asked more challenging questions. If the answer is

wrong, various computer messages will indicate the flaw and the program will bypass more complicated questions until the student shows mastery in that area. The use of computers has many advantages in educational instructions. They provide one-to-one interaction with a student, as well as an instantaneous response to the answers given and allow students to proceed at their own pace. Computers are particularly useful in subjects that require drill, freeing teacher's time from some classroom tasks so that a teacher can devote more time to individual students. Because of the privacy and individual attention given by a computer, some students are relieved of the embarrassment of giving an incorrect answer publicly or of going more slowly through lessons than other classmates. Implementation of computers for educational purpose has some drawbacks, that is, they are expensive to purchase, maintain and update. Readymade educational application packages related with various subjects are available for use in schools. Software can also be developed in-house, that is, a teacher could provide the software exactly tailored to the needs of the students but this is expensive, time-consuming and may require more programming expertise than is available.

4.2 WORD-PROCESSING

A typical advanced word-processing system consists of a high-speed printer that is linked to a computer that has an auxiliary storage unit. The computer enables the operator to input and also check, edit or revise the information to be entered. The computer records the text of the document, including all corrections, additions and deletions made by the user. When the final draft is ready to be prepared, the computer activates the printer, which produces as many copies as required. The information can be stored for reuse in the auxiliary memory of the computer such as hard disk or floppy disk. A word-processing system has the advantage of sharply reducing the time required to prepare documents. Moreover, changes can be made without having to retype an entire page as in manual operations.

4.3 RETAIL

Computer technology has had a significant impact on retail stores. Many small shops have replaced the old-fashioned cash register with a terminal linked to a computer system. Bar code readers are used in stores to directly read the Universal Production Code (UPC) printed on the each product sold. The receipt produced by the computer can include brief description of the items

purchased and the purchase information is also sent to the computer to cause an immediate adjustment in the inventory data. The inventory system can alert the manager when the supply of some items drops below a specified number. In the case of retail chains linked by networks, the order for a new supply of an item may be automatically generated and sent electronically to the supply warehouse. These developments have made shopping much more convenient. The checkout process is faster and the desired item is more likely to be in stock. In addition the receipts contain much more information than a simple list of item prices. Since the mid-1990s one of the most rapidly growing retail sectors, known as electronic commerce or e-commerce, involves the use of the Internet and proprietary networks to facilitate business-to-business, consumer and auction sales of everything imaginable from computers and electronics to books, recordings, automobiles and real estate.

4.4 E-COMMERCE

E-commerce can be defined as maintaining business relationships and selling information, services and commodities by means of computer telecommunication networks. Although in the vernacular e-commerce usually refers only to the trading of goods and services over the Internet, broader economic activity is included. E-commerce consists of business-to-consumer and business-to-business commerce as well as internal organizational transactions that support these activities. E-commerce originated in a standard for the exchange of business documents, such as orders or invoices, between suppliers and their business customers. With the introduction of the graphical browser software, such as Netscape and MS Internet Explorer, for accessing the World Wide Web in 1993, most e-commerce shifted to the Internet. In some fields new Internet retailers such as the bookseller Amazon.com grew up, seemingly overnight to challenge the dominance of traditional retailers. The Intel Corporation had sold almost half of its $30 billion in annual computer chips sales directly through its web site by 1999 and planned to move all its sales to the web by the end of 2000. Among other innovations that have contributed to the growth of e-commerce are electronic directories and search engines for finding information on the web. These services facilitate the sale of goods, the provision of services such as banking, ticket reservations and stock market transactions and even the delivery of remote education and entertainment. Several important phenomena are associated with e-commerce. The role of geographic distance in forming business relationships is reduced. Barriers to entry into the retail business are lower, as it is relatively inexpensive to start a retail web site. Some traditional business intermediaries

are being replaced by their electronic equivalents. For example, in developed countries, as airlines have published fare information and enabled ticketing directly over the Internet, travel agencies have declined.

4.5 ELECTRONIC BANKING

The banking business has been revolutionized by computer technology. Deposits and withdrawals are instantly logged into a customer's account. Computer-generated monthly statements are unlikely to contain any error unless they arise during manual entry of check amounts. The technology of electronic funds transfer, supported by computer networking, allows the amount of a grocery bill to be immediately deducted from the customer's bank account and transfer to the grocery store. Similarly, networking allows individuals to obtain cash instantly and almost worldwide by simply stepping up to an Automated Teller Machine (ATM) and providing the proper card and Personal Identification Number (PIN). The disadvantage of this technology is the security problems. Intruders can see packets travelling on a network and can perhaps interpret them if not carefully encrypted to obtain confidential information of financial transactions. Network access to personal accounts has the potential to let intruders not only see how much money an individual has but also to transfer some of it elsewhere.

4.6 COMPUTER GRAPHICS

Computer graphics refers to images or animated motion pictures displayed on a video display unit or printed on a printer. A computer-graphics system basically consists of a computer to store and manipulate images, various input and output devices and a graphics software package that enable a computer to process graphic images. These packages enable a computer to draw, color, shade and manipulate the images held in its memory. A picture can be drawn on the screen with the use of a mouse, a pressure-sensitive tablet or a light pen. Preexisting images on paper can be scanned into the computer through the use of scanners or digital cameras. Frames of images on videotape also can be entered into a computer. Digital data can be sent from the computer's memory to film recorder, which can print it on photographic film. Computers can also print hardcopy in multi-color by means of plotters, inkjet or laser printers. Computer graphics have found widespread use in printing, product design and manufacturing, scientific research and entertainment. In the business office, computers routinely create graphs and tables to illustrate text

information. Computer systems have replaced drafting boards in the design of a vast array of products ranging from buildings to automotive bodies and aircraft hulls to electrical and electronic devices. Computers are also often used to test various mechanical, electrical or thermal properties of complicated systems in animated motion-picture sequences. This pictorial visualization can afford a clearer understanding of the multiple forces or variables at work in such phenomena as nuclear and chemical reactions. Computer graphics is very popular in entertainment industry, which uses them to create the interactive animation of video games and the special effects in motion pictures.

4.7 COMPUTER SIMULATION

Computer simulation is the use of a computer to represent the dynamic responses of one system by the behavior of another system modeled after it. A simulation uses a mathematical description or model of a real system in the form of a computer program. This model is composed of equations that duplicate the functional relationships within the real system. When the program is run, the resulting mathematical model forms a similar behavior of the real system with the results presented in the form of data. A simulation can also take the form of a computer-graphics image that represents dynamic processes in an animated sequence. Computer simulations are used to study the dynamic behavior of objects or systems in response to conditions that cannot be easily or safely applied in real life. For example, a mathematical model that incorporates such variables as heat, velocity and radioactive emissions can describe a nuclear blast. Additional mathematical formulas can then be used to adjust the model to changes in certain variables, such as the amount of fissionable material that produced the blast. Simulations are especially useful in enabling observers to measure and predict how the functioning of an entire system may be affected by altering individual components within that system. Simulations performed by personal computers consist mainly of business models and geometric models. Business models include spreadsheet, financial and statistical software programs that are used in business analysis and planning. Geometric models are used for applications that require simple mathematical modeling of objects, such as buildings, industrial parts and the molecular structures of chemicals. More advanced simulations, such as those that emulate weather patterns or the behavior of macroeconomic systems are usually performed on powerful workstations or on mainframes. In engineering, computer models of newly designed structures undergo simulated test to determine their responses to stress and other physical variables. Simulations of river systems can be manipulated to

determine the potential effects of dams and irrigation networks before any actual construction has taken place. Other examples of computer simulations include estimating the competitive responses of companies in a particular market and reproducing the movement and flight of space vehicles.

4.8 COMPUTER-INTEGRATED MANUFACTURING

Since about 1970 there has been a growing trend in manufacturing firms towards the use of computers to perform many of the functions related to design and production. The technology associated with this trend is called CAD/CAM, for Computer-Aided Design and Computer-Aided Manufacturing. Today it is widely recognized that the scope of computer applications must extend beyond design and production to include the business functions of the firm. The name given to this more comprehensive use of computers is Computer-Integrated Manufacturing (CIM). CAD/CAM is based on the capabilities of a computer system to process, store and display large amounts of data representing part and product specifications. For mechanical products, the data represent graphic models of the components. For example, for electrical products, they represent circuit information. CAD/CAM technology has been applied in many industries, including machine components, electronics products and equipment design and fabrication for chemical processing. CAD/CAM involves not only the automation of the manufacturing operations but also the automation of elements in the entire design and manufacturing procedure. Computer-Aided-Design (CAD) makes use of computer systems to assist in the creation, modification, analysis and optimization of design. The designer, working with the CAD system rather than the traditional drafting board, creates the lines and surfaces that form the object and stores this model in the computer database. By invoking the appropriate CAD software, the designer can perform various analyses on the object, such as, heat transfer calculations. The final object design is developed as adjustments are made on the basis of these analyses. Once the design procedure has been completed, the computer aided design system can generate the detailed drawings required to make the object. Computer-Aided Manufacturing (CAM) involves the use of computer systems to assist in planning, control and management of production operation. This is accomplished by either direct or indirect connections between the computer and production operations. In the case of direct connection, the computer is used to monitor or control the processes in the factory. Computer process monitoring involves the collection of data from the factory, the analysis of the data and the communication of process-information results to plant

management. These measures increase the efficiency of plant operation. Indirect connection between the computer system and the process involves application in which the computer supports the production operations without actually monitoring or controlling them.

4.9 WEATHER FORECASTING

Computers are very useful in modern weather forecasting as they produce more accurate results than in the past. Large amount of data is collected and assimilated to produce accurate weather forecast. The data is collected from weather stations, weather ships, aircraft, airports and satellites that are situated all around the world. This data consists of physical quantities such as air pressure, humidity, temperature, wind speed and cloud cover. To produce an accurate weather forecast the computer processes this data. A very powerful computer is required because of the complexity of some of the calculations and the speed at which they need to be performed.

Weather reports are also stored on the computer. This means it is possible to find out whether the weather situation was the same in previous years. This information can be used to predict weather trends.

The computer can also produce weather charts using graph plotter connected to the computer.

4.10 COMPUTER IN MEDICAL FIELD

Computers are used in all the modern hospitals to perform a variety of tasks related with records of patients, monitoring instruments and diagnosis.

Records of Patients

Computers can be used to provide a complete, accurate, up-to-date and readily available source of information about patients' health. Records of patients are usually kept for the duration of their life. In the past a large amount of space was taken up by paperwork. There were also problems in finding a particular patient's file.

Most hospitals now store patients' records on magnetic tapes or disks. The information can be found immediately by the computer. There are terminals at

certain places in the hospital. The doctors or nurses can find details on a patient very quickly.

New information can be added to the patients' records by keying the information into the computer via a terminal. So the patient's record can be kept up-to-date with the latest information about his condition or circumstances.

Doctors and nurses used to spend about 30% of their time processing information in files but now this has been vastly reduced because of the introduction of computers.

Monitoring Instruments

In Intensive Care Units, computers are used to monitor instruments which record important data about the patient. If the data moves outside a certain limit, an alarm is sounded so that immediate medical help can be sought.

The measurements constantly taken by the computer would include blood pressure, pulse rate, heart wave shape from ECG, respiration rate and volume and electrical signals from the brain. Previously, this information needed to be taken so regularly that a nurse was needed for each patient. Now one nurse can look after many more patients.

Computers are also used to monitor vital measurements during surgery in the operating theater.

Diagnosis

Computers can be used to locate tumors at an early stage. Body scanners are used which send rays into the human body. After passing into the human body the rays are picked up by a detector. Signals from the detector are analyzed by the computer and are converted to a digital form which can then be displayed as a picture on a television screen. On the screen the tumor appears as a dark spot.

4.11 SUMMARY

Computer is a general purpose machine. It can solve a large variety of problems related with all the aspects of human life. The following are some of the examples of the major areas of its application.

EDUCATION

Computer is a very useful tool in the field of education. It is used bye students from primary education to university level. It can help students for teaching various topics. A large variety of educational application packages related with various subjects are available for use in schools.

WORD-PROCESSING

Word-processing application packages are used in organizations for preparing documents and reports. These packages provide the facilities to the user to store, edit and spell check the information entered at the keyboard and print it.

RETAIL

Modern retail stores use bar code readers attached to computer systems. A bar code reader directly reads the bar code printed on each product which represents a brief description and price of the product and helps in producing a receipt for the customer. The advantages of using bar code system in retail stores is that the checkout process is fast and the receipts contain much more information than a simple list of items.

E-COMMERCE

E-commerce refers to maintaining business relationships and selling information services and products by means of telecommunication networks. It provides the facilities for sale of goods, services such as banking, ticket reservations and stock market transactions and even remote education and entertainment. These days most e-commerce shifted to internet since it is relatively inexpensive to start a retail web site.

ELECTRONIC BANKING

Electronic banking has many advantages such as deposits and deposits and withdrawals are instantly logged into a customer's account. ATMs are used world wide to obtain cash instantly. Modern computer networks allow our

bills at retail stores to be immediately deducted from our bank accounts and transfer to the retail store.

COMPUTER GRAPHICS

Computer graphics is defined as images or animated motion pictures displayed on a monitor or printed on a printer. Computer graphics plays an important role in printing product design and manufacturing, scientific research, advertisement and entertainment. Very powerful graphics packages are available to draw, shade and manipulate images.

COMPUTER SIMULATION

A simulation uses a mathematical model of a real system in the form of a computer program to represent the dynamic response of a system by the behavior of computer program. A simulation is very often in the form of computer graphics images that represents dynamic processes in an animated sequence. Simulations are especially useful to measure and predict how the functioning of an entire system may be effected by altering individual components within that system.

COMPUTER-INTEGRATED MANUFACTURING

Computers are widely used by manufacturing firms to perform many of the functions related to design and production. The technology related with this is called CAD/CAM, for Computer Aided Design and Computer Aided Manufacturing respectively. CAD makes use of computer systems in the creation modification, analysis and optimization of design. CAM involves the use of computer systems to assist in planning, control and management of production operation.

WEATHER FORECASTING

Modern weather forecast is produced by using computer systems. Physical data such as air pressure, humidity, temperature, wind speed and cloud cover are collected from weather stations, weather ships and aircrafts. The computer processes this data to produce an accurate weather forecast.

COMPUTER IN MEDICAL FIELD

Computer are used in all the modern hospitals to perform a variety of tasks related with records of patients, monitoring instruments and diagnosis.

Computers are used in hospitals to store complete accurate and up-to-date information about patients and new information can be added any time. The doctors and nurses can very easily and quickly find details of a patient.

Computers are used in Intensive Care Unit to monitor instruments which record important data about the patient. An alarm is sounded for immediate medical help if the data moves outside a certain limit.

Body scanners are used in hospitals to diagnose patients for various diseases.

4.12 EXERCISE

1. Fill in the blanks.
   i) Word processing systems have replaced the ..... in many offices.
   ii) UPC stands for .....
   iii) Electronic banking allows individuals to obtain cash instantly from .....
   iv) A ..... uses a mathematical description or model of a real system in the form of a computer program.
   v) ..... makes use of computer systems to assist in the creation, modification, analysis and optimisation of design.
   vi) ..... involves the use of computer system to assist in planning, control and management of production operations.
   vii) CIM stands for .....
   viii) Maintaining business relationship and selling information services and commodities by means of computer telecommunication networks is known as.

2. Explain how computers can be useful in education.

3. Explain how computers can be useful in business.

4. What is meant by computer simulation? Explain where computer simulations are used and what are the advantages of using them.

5. Define the following terms related with manufacturing.
   i) Computer-Aided Designing (CAD).
   ii) Computer-Aided Manufacturing (CAM).
   iii) Computer-Integrated Manufacturing (CIM).

6. Explain how computers can be useful in medical field.

7. Give two important applications of computers, which are not mentioned in this chapter.

8. Briefly describe computer graphics

9. How computer can be useful in weather forecast?

CHAPTER 5

COMPUTER ARCHITECTURE

A computer is a machine that processes information. What we mean by "processes" is that the information put into the computer has something done to it. Sometimes the computer is asked to do calculations with the information. Sometimes we ask the computer just to store the information so that it can be easily found when we need it. Computers have the capabilities to store and process a large amount of information at extremely high speed and produce highly accurate results. Computer can work 24 hours a day and can do some jobs that would be impossible without them.

The last 10 years has seen a computer revolution that has produced computers with speed and computing power thousands of times greater than the first commercial computers while being no larger than a typewriter. This revolution occurred as a result of integrated circuits that combine many electronic components on a single silicon chip. In particular, large-scale integration (LSI) and very-large-scale integration (VLSI) technologies can put tens of thousands of transistors on a single chip. This has made it possible to fabricate the entire brain of a computer as a single integrated circuit called a **microprocessor**. The addition of a relatively small number of other chips produces a complete microcomputer.

From the first digital computers of the 1940s to today's powerful full-size computers and revolutionary microcomputers, very little change has occurred in the basic principles of operation. Although the technology has come a long way from the time when a computer filled a big room and was considered too costly for most applications. Modern computers still work with binary numbers (1s and 0s) using the same basic logic operations as their predecessors. In this chapter many of the concepts, principles and operations that are common to all types of computers are presented

Despite the differences in performance among the various types of computers every computer contains five basic units, that is, the **memory unit**, **arithmetic logic unit** (ALU), **input unit**, **output unit** and **control unit** as shown in Fig.5.1.

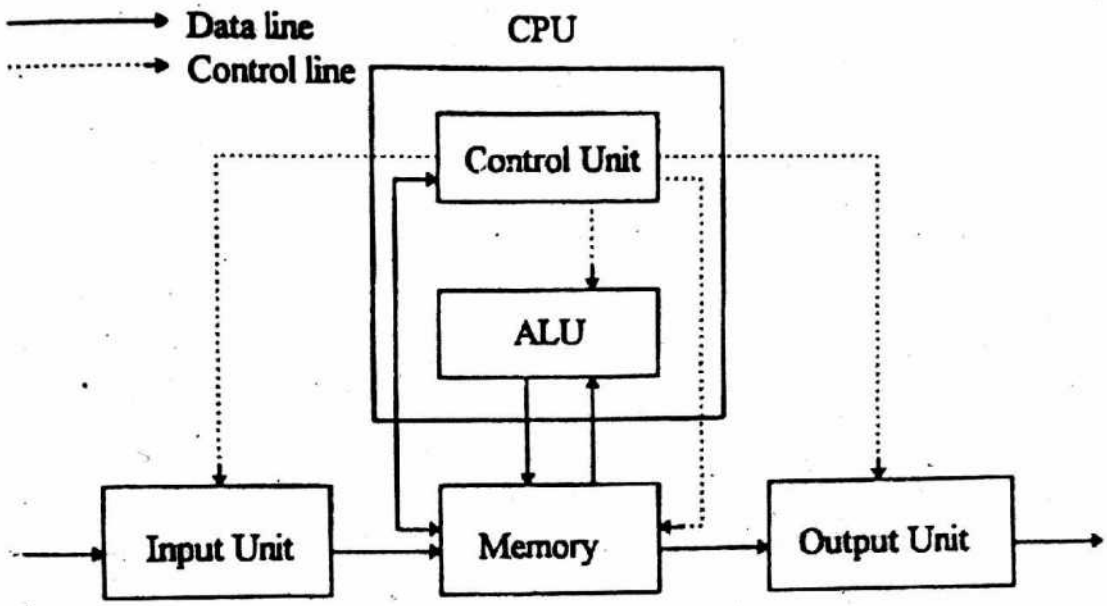

Fig.5.1 Block diagram of a computer.

5.1 CENTRAL PROCESSING UNIT (CPU)

The ALU and control unit of a computer are combined into a single unit called the Central Processing Unit. The CPU is truly the "**brain**" of the computer because it combines the circuitry that generates all the control signals needed to execute an instruction with the circuitry that actually performs the operations called by the instructions.

5.1.1 Arithmetic Logic Unit

Arithmetic logic unit is the part of the computer where the actual processing takes place. ALU is capable of performing arithmetic, logical and data manipulation operations on binary numbers. The circuitry that performs these operations consists of logic circuits such as adders, subtracters, comparators, etc.

The ALU consists of logic circuitry that will perform operations such as addition, subtraction, multiplication, division, square roots, exponentials, data manipulations (for example, shifting), comparisons and logical operations such as AND, OR etc. on the two binary numbers contained in the two input registers. Some or all of these operations are available in any computer depending on its sophistication and complexity. Small, cheap microcomputers

have an ALU that can only do a few simple operations. However, through proper programming even these simple computers can be made to perform the more complex operations but at slow speed.

A typical ALU is shown in Fig.5.2 together with its associated registers. The two registers feed the two binary numbers on which the ALU will operate. These numbers are referred to as operands and the ALU operates on them in accordance with the control inputs coming from the control unit. For example, one operand is stored in the Data Buffer Register (B) and the other operand is stored in the Accumulator Register (A). The control inputs determine what the ALU will do with these operands. The result of the operation appears at the ALU output and is then immediately transferred to the accumulator. In other words, the results of any ALU operations end up stored in accumulator.

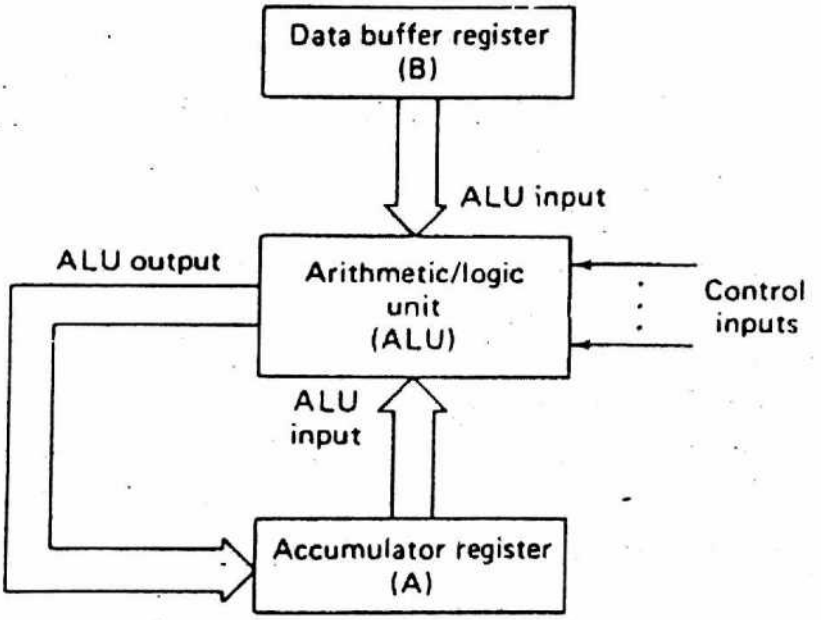

Fig.5.2 Arithmetic Logic Unit.

For example, if two numbers are to be added say 5 and 9. 5 may be stored in A and 9 in B. These are called operands. Control unit will set its adder control line which in turn will activate the adder circuit. These two numbers, 5 and 9 will be added and the result 14 will be stored into Accumulator (A).

5.1.2 Control Unit

A digital computer is a general purpose digital system. A general-purpose digital computer is capable of executing various operations and in addition, can be instructed as to what specific sequence of operations it must perform.

The user of such a system can control the process by means of a program, that is, a set of instructions that specify the operations, operands and the sequence by which processing has to occur. The data processing task may be altered simply by specifying a new program with different instructions or specifying the instructions with different data. A computer instruction is a binary code that specifies a sequence of micro-operations for the computer. Instruction codes together with data are stored in memory. The control unit fetches an instruction from main memory by sending an address and a READ command to the main memory. The instruction word comes from memory in the control unit. The instruction which is in binary code is then decoded by logic circuits in the control unit to determine which operation is to be performed. Once this is determined, the control unit generates the signals needed to actually execute the operations.

Thus, we can say that the control unit's function is to fetch, decode and execute the instructions that are in memory. The control unit contains logic and timing circuits that generate the signals needed to execute each instruction of a program one by one. The control unit performs these same steps till the last instruction of the program is executed. It directs and coordinates the operation of all the other parts of the computer by providing timing and control signals.

5.2 MAIN MEMORY

Main memory stores groups of bits (words) that represent instructions that the computer is to execute (that is a program) and data that are to be operated on by the program. It also serves as storage for the results of operations performed by the ALU. The main memory operation is controlled by the control unit, which signals either a READ or a WRITE operation and provides the appropriate memory address. Data that is to be written into main memory can come from the ALU, or the input unit, again under the control of the control unit. Data that is read from memory can be sent to ALU or the output unit. Main memory is low-capacity, high-speed, and expensive memory that stores programs and data that the computer is currently executing. Semiconductor RAM and ROM are commonly used as main memory. Main memory is also known as primary memory or internal memory and it can be shared by multiple users' programs simultaneously.

i) RAM

The term RAM stands for Random Access Memory, meaning that any memory word is as easily accessible as any other. When the term RAM is used with semiconductor memories, it is usually taken to mean READ/WRITE memory as opposed to ROM.

RAMS are used in computers for the storage of active programs and data. The contents of RAM change continually as the computer executes a program. This requires fast READ and WRITE operations for the RAM so as not to slow down the computer operation.

The major disadvantage of RAM is that it is volatile and will lose all stored information if power is turned off.

RAM plays very important role in the processing speed of the computer. Large RAM size provides larger amount of information to a computer for processing and hence increases the processing speed.

ii) ROM

The term ROM stands for Read Only Memory. This type of semiconductor memory is designed to hold information that is either permanent or will not change frequently. During normal operation, no new data can be written into a ROM, but data can be read from ROM. For some ROMs, the data can be entered during the manufacturing process; for other ROMs the data can be entered electrically. The process of entering data is called programming the ROM. Some ROMs cannot have their data changed once they have been programmed; others can be erased and reprogrammed as often as required by the manufacturers. ROMs are used to store programs that are frequently required and are not to change during the operation of the computer. Because all ROMs are nonvolatile, these programs are not lost when the computer is turned off. One of the main function of programs stored in ROM is to make the computer ready for operations.

There are primarily three types of read-only memory. ROM refers to IC chips that are masked or programmed by the manufacturer. A PROM is a semiconductor chip that is obtained from the manufacturer in an unprogrammed state and the user programs it according to his desire. A PROM is programmed outside of the circuit where it is to be used and many commercially available machines, called **prom programmers** are used to

program it. Another type of ROM called an Electrically Erasable PROM or EEPROM is also being used for ROM applications. The EEPROM can be altered while being used in a logic board by using special power circuits and write pulse generators. The EEPROM can work like a read/write semiconductor memory while retaining the nonvolatile nature of ROMs and PROMs.

5.3 INPUT UNIT

The input unit is used to communicate with the computer. It consists of devices that accept data and information from the outside world in human readable form and convert it into machine readable form before providing it to the main memory. These devices are often referred to as peripherals because they are physically separated from the electronics that make up the "brain" of the computer. Some typical input peripherals are punched-card readers, keyboards, teleprinters (also called teletypewriter), mouse, joystick and stylus (a type of pen by which one can write on the screen of the computer). Most personal computers come equipped with a keyboard and a mouse as input devices, other input peripherals have to be purchased at extra cost.

It is not unusual to consider magnetic tape and disk units to be both input and memory devices. One of their major functions is to store data and programs that will be fed to the computer's main memory upon commands from the control unit.

5.4 OUTPUT UNIT

The output units consist of peripheral devices that transfer information from the main memory to the outside world. Computers perform all the operations in binary code and the results produced are also in binary form. The output unit receives the results in binary form and converts it into human readable form before communicating it to the user. Typical output peripherals include video display unit, printers, plotters, teleprinters and fax machine. Note that teleprinters and modems can serve as both an input and an output device.

Magnetic tape and disk memory units can also be considered output peripherals as data and programs are often recorded to one of these external storage memory devices for long-term storage.

5.5 BUSES AND REGISTERS

The simplified diagram of a microprocessor is shown in Fig.5.3. The microprocessor is the portion enclosed by heavy black lines and it is shown connected to the memory unit. We will assume that the program and data is already in memory. There are three buses external to the microprocessor and two buses within the microprocessor. The external address and data buses are extension of the same buses inside the microprocessor, so there are really only three different buses, address, data and control. The numbers in bracket in Fig.5.3 indicate how many signal lines make up each bus.

The address bus is a 16-bit bus. It carries the 16-bit address code from the microprocessor to the memory unit to select the memory location which the microprocessor is accessing for a Read or Write operation. The address bus is unidirectional bus because information flows in only one direction.

The data bus is an eight-line bidirectional bus over which 8-bit words can be sent from the microprocessor to memory (Write operation) or from the memory to the microprocessor (Read operation). Although, it is called data bus, the information carried on this will not always be data, it will often be instruction codes fetched by the microprocessor.

The control bus is a grouping of all the timing and control signals needed to synchronize the operations of the microprocessor with the other units of the microcomputer. Some of the control lines are outputs from the microprocessor and others are inputs to the microprocessor from I/O devices. Most 8-bit microprocessors have an 8-bit data bus and 16-bit address bus.

Microprocessor Registers

Microprocessor contains the ALU and control unit portions of a microcomputer. It also contains several registers that are used to store various kinds of information needed by the microprocessor as it performs functions. In other words these registers serve as dedicated memory locations inside the microprocessor chip.

Each register shown in Fig.5.3 is indicated by its full name and its abbreviation and by a number in brackets specifying the size of the register in bits. We will use these abbreviations in the discussions that is followed.

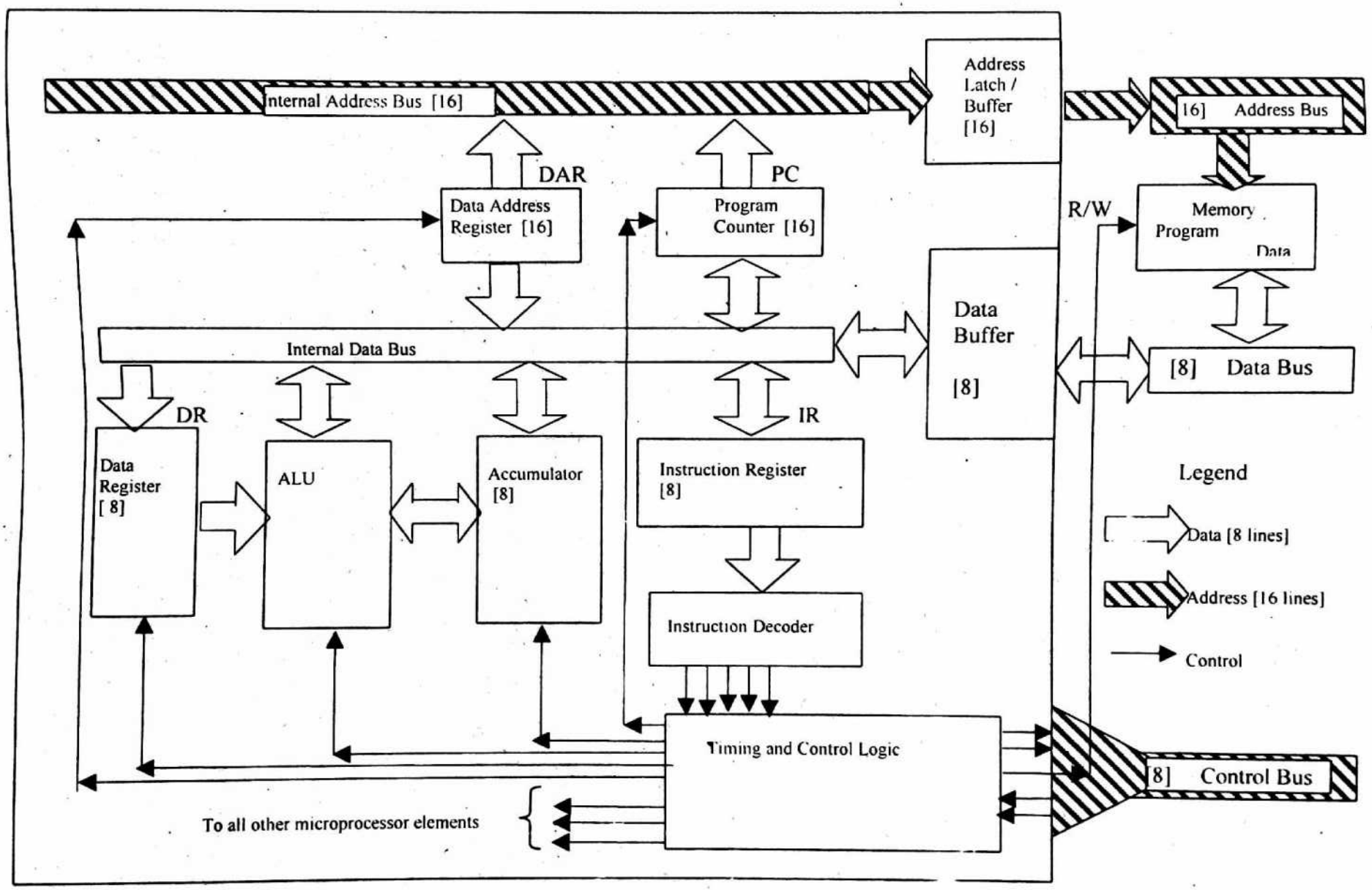

Figure 5.3 A simple diagram of a micro-processor

Note that most of the registers are connected to the internal data bus so that information can be transferred between these registers and the memory unit over the data bus.

The Program Counter (PC)

This register normally functions as a 16-bit counter that controls the sequence in which the instructions are fetched from memory. At any given instant, the contents of the PC indicate the address in memory from which the next byte of instruction code is to be fetched.

Whenever the microprocessor is to fetch a byte of instruction code, control signals from the timing and control block will place the contents of the PC onto the internal address bus and latch them into the address latch/buffer that drives the external address bus. This presents the memory unit with a 16-bit address code equivalent to the count of the PC. The PC count is then incremented to prepare for the next instruction fetch operation.

Data Address Register (DAR)

The PC provides an instruction code address to the memory unit during an instruction fetch operation. The DAR provides an operand address to the memory unit when the microprocessor has to access memory during the execution phase of an instruction. For example, during the execution of a store the accumulator instruction, the DAR will hold the operand address corresponding to the memory location where the contents of the accumulator is to be stored. Signals from the timing and control block will place the contents of the DAR onto the internal address bus and latch them into the address latch/buffer.

Thus, we can say that the PC always holds instruction addresses that refer to the program portion of memory and the DAR always holds data addresses that refer to the data portion of memory.

The Instruction Register (IR)

To fetch an instruction from program memory, the microprocessor's control circuitry generates signals that place the contents of the PC on the address bus, sets the Read/Write operation bit to Read, takes the resulting memory word from the data bus and loads it into the instruction register (IR). Thus, at the completion of a fetch operation, the IR holds the instruction.

The IR holds the instruction while the instruction decoder circuit decodes it and signals the timing and control logic to generate the proper sequence of control signals to complete the execution of the indicated instruction.

The Accumulator (A) and Data Register (DR)

These two registers hold the operands that the ALU operates on during the execution phase of an instruction. The operands are loaded into these registers from memory. The results of an ALU operation are then transferred to the accumulator. Note that both the accumulator and the DR can receive data from memory over the data bus but only the accumulator can send data to memory.

5.6 INSTRUCTION CODES

An instruction code is a group of bits that tells the computer to perform a specific operation. It is usually divided in parts, each having its own particular interpretation. The most basic part of an instruction code is its operation part. The operation code of an instruction is a group of bits that define such operations as add, subtract, multiply, shift, and complement. The set of operations formulated for a computer depends on the processing it is intended to carry out. The total number of operations thus obtained determines the set of machine operations. The number of bits required for the operation part of an instruction code is a function of the total number of operations used. It must consist of at least n bits for a given 2^n (or less) distinct operations. As an illustration, consider a computer with 32 distinct operations, one of them being an ADD operation. The operation code consists of five bits, with a bit configuration 10010 assigned to the ADD operation. When this operation code is received by the control unit, it issues control functions which read an operand from memory and add the operand to a processor register.

At this point we must recognize the relationship between an operation and a micro-operation. An operation is part of an instruction stored in computer memory. It is a binary code that tells the computer to perform a specific operation. The control unit receives the instruction from memory and interprets the operation code bits. It then issues a sequence of control functions that perform micro-operations in internal computer registers. For every operation code, the control unit issues a sequence of micro-operations needed for the hardware implementation of the specified operation.

The operation part of an instruction code specifies the operation to be performed. This operation must be executed on some data stored in memory and/or processor register. An instruction code, therefore, must specify not only the operation but also the registers and/or the memory words where the operands are to be found, as well as the register or memory word where the result is to be stored. Memory words can be specified in instruction codes by their address. Processor registers can be specified by assigning to the instruction another binary code of k bits that specifies one of 2^k registers. There are many ways of arranging the binary code of instructions and each computer has its own particular instruction code format. Instruction code formats are conceived by computer designers who specify the architecture of the computer. There are as many instruction code formats as there are computers. In this chapter we choose a particular instruction code to explain the basic organization of digital computers. The simplest way to organize a computer is to have one processor register and an instruction code format with two parts. The first part specifies the operations to be performed and the second specifies an address. The address tells the control unit where to find the operand in memory. This operand is read from memory and used as the data to be operated on together with the data stored in the processor register.

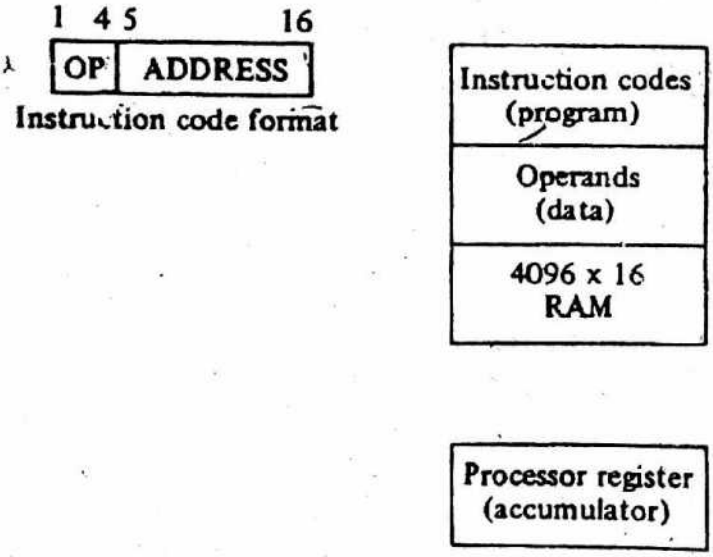

Fig.5.4. Stored program organization.

Fig.5.4 shows this type of organization. Instructions are stored in one section of memory and data in another. For a memory unit with 4096 words we need 12 bits to specify an address since 2^{12}=4096. If we store each instruction code in one 16-bit memory word, we have available four bits to specify one out of 16 possible operations and 12 bits to specify the address of an operand. The control unit reads a 16-bit instruction from the program portion of memory. It

uses the 12-bit address part of the instruction to read an operand from the data portion of memory. It then executes the operation by means of micro-operations between the operand and the processor register. Computers that have a single processor register usually assign to it the name accumulator and label it AC or A.

If an operation in an instruction code does not need an operand from memory, the rest of the bits in the instruction can be used for other purposes. For example, operations such as clear AC, complement AC and increment AC operated on data stored in the AC register. They do not need an operand from memory. For these types of operations, the second part of the instruction code, that is, bits 5 to 16 is not needed for specifying a memory address and can be used to specify other operations for the computer.

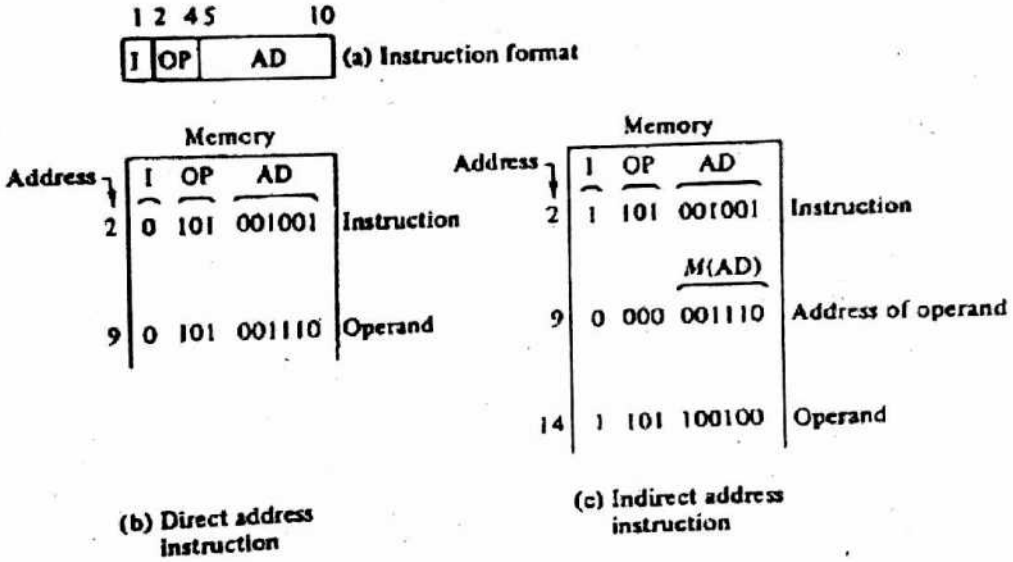

Fig.5.5 Direct and indirect address instructions

It is sometimes convenient to use the address bits of an instruction code not as an address but as the actual operand. When the second part of an instruction code specifies an operand, the instruction is said to have an immediate operand. When the second part specifies the address of an operand, the instruction is said to have a direct address. This is in contrast to a third possibility called indirect address, where the bits in the second part of the instruction designate an address of a memory word in which the address of the operand is found. It is customary to use one bit in the instruction code to distinguish between a direct and an indirect address.

As an illustration of this concept, consider the instruction code format shown in Fig.5.5 (a). It consists of a three-bit operation code designated by OP, a six-bit address part designated by AD and an indirect-address mode bit designated by I. The mode bit is 0 for a direct address and 1 for an indirect address. A direct address instruction is shown in Fig.5.5 (b). It is placed in address 2 in memory. The I bit is 0, so the instruction is recognized by the control unit as a direct address instruction. Since the address part of AD is equal to the binary equivalent of 9 (001001), the instruction finds the operand in memory at address 9. The instruction in address 2 shown in Fig.5.5 (c) has a mode bit I=1. Therefore, it is recognized as an indirect address instruction. The address part is the binary equivalent of 9. The control unit goes to address 9 to find the address of the operand. This address is in the address portion of the word and is designated by M(AD). Since M(AD) contains 14 (binary 001110), the control unit finds the operand in memory at address 14. The indirect address instruction needs two references to memory to fetch an operand. The first reference is needed to read the address of the operand and the second is for the operand itself.

5.7 COMPUTER INSTRUCTIONS

Computer instructions are normally stored in consecutive memory locations and are executed sequentially one at a time. The control unit reads an instruction from a specific address in memory and executes it. It then continues by reading the next instruction in sequence and executes it, and so on. This type of instruction sequencing needs a counter to calculate the address of the next instruction after the execution of the current instruction is completed. Moreover, memory words cannot communicate with processor registers directly without going through an address and buffer register. It is also necessary to provide a register in the control unit for storing operation codes after they are read from memory. These requirements dictate the register configuration shown in Fig.5.6. This register configuration will be used to describe the internal organization of a basic digital computer.

The memory unit has a capacity of 4096 words and each word contains 16 bits. Twelve bits of an instruction word are needed to specify the address of an operand. This leaves four bits for the operation part of the instruction. However, only three bits are used to specify an operation code. The fourth bit is used to specify a direct or indirect addressing mode. The Memory Buffer Register (MBR) consists of 16 bits, as does the AC (accumulator) register. The

E bit is an extension of the AC. It is used during shifting operations and it receives the end-carry during addition.

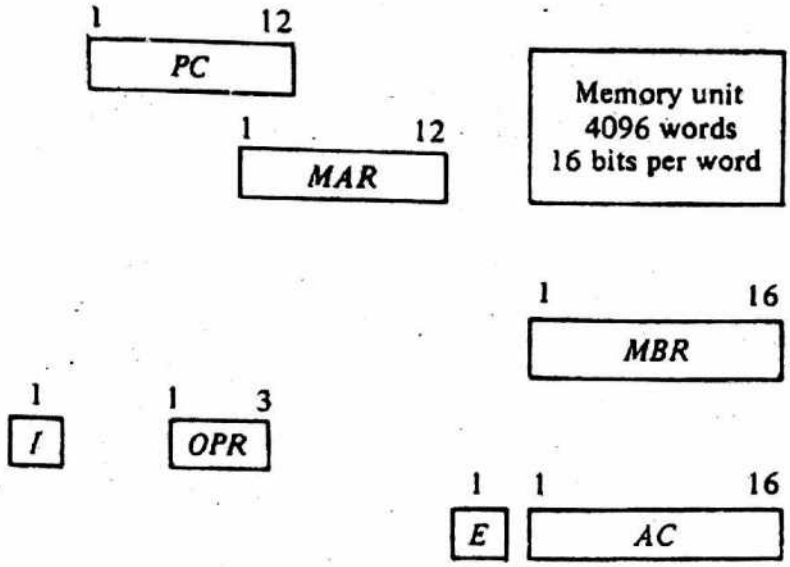

Fig.5.6 The basic computer registers.

The memory address register (MAR) has 12 bits since this is the length of a memory address. The program counter (PC) also has 12 bits and it holds the address of the next instruction to be read from memory after the current instruction is executed. This register goes through a counting sequence and causes the computer to read sequential instructions previously stored in memory. Instruction words are read and executed in sequence unless a branch instruction is encountered. A branch instruction has an operation part that calls for a transfer to a nonconsecutive instruction in memory. The address part of a branch instruction is transferred to PC to become the address of the next instruction. To read an instruction, the content of PC is transferred to MAR, a memory read cycle initiated and PC is incremented by one. This places the instruction code into MBR and prepares PC for the address of the next instruction. The operation code is transferred to OPR, the mode bit into I and the address part into MAR. A memory read operation places the operand (if I=0) into MBR. The AC and the MBR are used as the source register for the micro-operations specified by the operation code. The result of the operation is stored in the AC.

However, an instruction may have an indirect bit I equal to 1, or may not require an operand from memory, or may be a branch instruction. In each of these cases, the control unit must issue a different set of control functions to execute different types of register transfers. In order to investigate the role that

the control unit plays in executing instructions it is necessary to define the computer instructions and their code formats.

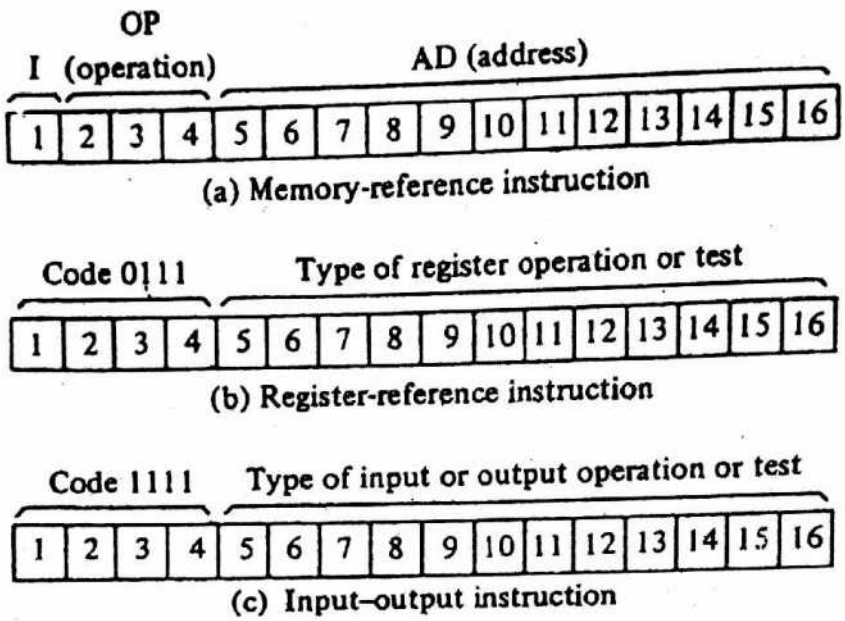

Fig.5.7 Instruction formats for the basic computer.

The basic computer has three different instruction code formats, as shown in Fig.5.7. The operation part of the instruction contains three bits; the meaning of the remaining thirteen bits depends on the operation code encountered. A memory-reference instruction uses the last 12 bits to specify an address and the first bit to specify the mode I. A register-reference instruction specifies an operation on or a test of the AC or E register. An operand from memory is not needed. Therefore, the last 12 bits are used to specify the operation or test to be executed. A register-reference instruction is recognized by the operation code 111 with a 0 in the first bit of the instruction. Similarly, an input-output instruction does not need a reference to memory and is recognized by the operation code 1111 with a 1 in the first bit of the instruction. The remaining 12 bits are used to specify the type of input-output operation or test performed. Note that the first bit of instruction code is not used as a mode bit when the last 12 bits are not used to designate an address.

Only three bits of the instruction are used for the operation code. It may seem that the computer is restricted to a maximum of eight distinct operations. However, since register-reference and input-output instructions use the remaining 12 bits as part of the operation code, the total number of instructions can exceed eight.

The instructions for the computer are listed in Table5.1. The symbol designation is a three-letter word and represents an abbreviation intended for

programmers and users. The hexadecimal code is equal to the equivalent hexadecimal number of the binary code used for the instruction. By using the hexadecimal equivalent we reduced the 16 bits of an instruction code to four digits with each hexadecimal digit being equivalent to four bits. A memory-reference instruction has an address part of 12 bits. The address part is denoted by the symbol AD and must be specified by three hexadecimal digits. The first bit of the instruction is designated by the symbol I. When I=0, AD is the address of the operand. In this case, the four bits of an instruction have a hexadecimal designation from 0 to 6 since the first bit is 0. When I=1, AD is the address where the address of the operand is to be found in memory. The hexadecimal digit equivalent of the first four bits of the instruction ranges from 8 to E since the first bit is 1.

Table 5.1. Computer Instructions.

Symbol	*Hexadecimal Code*			*Description*
	I = 0	*I = 1*	*Address*	
AND	0	8	*AD*	AND memory word to *AC*
ADD	1	9	*AD*	Add memory word to *AC*
LDA	2	A	*AD*	Load *AC* from memory
STA	3	B	*AD*	Store *AC* into memory
BUN	4	C	*AD*	Branch unconditionally
BSA	5	D	*AD*	Branch and save return address
ISZ	6	E	*AD*	Increment and skip if zero
CLA	7800			Clear *AC*
CLE	7400			Clear *E*
CMA	7200			Complement *AC*
CME	7100			Complement *E*
CIR	7080			Circulate right *E* and *AC*
CIL	7040			Circulate left *E* and *AC*
INC	7020			Increment *AC*
SPA	7010			Skip if *AC* is positive
SNA	7008			Skip if *AC* is negative
SZA	7004			Skip if *AC* is zero
SZE	7002			Skip if *E* is zero
HLT	7001			Halt computer
I/O	FXXX			Input-output instructions

Register-reference instructions use 16 bits to specify an operation. The first four bits are always 0111 which is equivalent to hexadecimal 7. The other three hexadecimal digits give the binary equivalent of the remaining 12 bits. The input-output instructions also use all 16 bits to specify an operation. The first four bits are always 1111 which is equivalent to hexadecimal F. The three

X's following the F for an input-output instruction are digits that distinguish between the different I/O instructions.

5.8 SYSTEM SOFTWARE

System software can be subdivided into three categories, that is, operating systems, operating environment and utilities.

Operating Systems

A computer's operating system enables it to carry out its disk filing and other operational tasks. We can put most of these tasks under four headings:

- Disk operations which are to do with storing programs and data on disk.
- Network operations which enable a number of micros to be linked to each other and to share facilities such as hard disks and printers.
- Multi-tasking which enables the computer to handle several tasks at the same time such as running a spreadsheet, a word-processing and a database management program.
- Multi-user operations which allow a number of people to use the computer and its software at the same time, by connecting it to other PCs or workstations.

Operating Environment

DOS and most other operating systems are not 'user-friendly'. Their commands are awkward to memorize and use and if you are not familiar with the computer keyboard they are awkward to type. Also the computer screen with its enigmatic C:\> is rather unfriendly and difficult to come to terms with. Most people appreciate something that resembles more closely, the familiar world of office with its folders, wastepaper basket and so on.

Hence, the operating environments, software which sits on top of the operating system and presents us with an easy-to-use and friendly way of performing the tasks were introduced. The two most popular operating environments on microcomputers are:

1. Windows from Microsoft, available for all PC-compatibles used on 80386 models and above. This is identical to Presentation Manager (PM) used on the IBM PS/2 range of micros.

2. The Apple Macintosh operating environment and the almost identical GEM from Digital Research. GEM is short of 'Graphics Environment Manager' and is available on the Atari ST, PC-compatibles and some other micros.

These operating environments were introduced to make the interaction between people and computers more user-friendly. Pressing the arrow keys on the keyboard to move around the screen, for instance, is not very efficient or natural and so the mouse was developed. Moving it across your desk produces corresponding movements of the cursor on the screen. Selecting files or software options by typing at the keyboard is also unnatural and inefficient, so a button is provided at the front of the mouse. Now, to make your selection, you merely push the mouse to move to the file or the option displayed on the screen and click the button. In the case of a program, you run it by double clicking, that is, pressing the button twice in quick succession.

People find the conventional text-based display unfriendly and difficult to use, preferring instead one that was graphics based. In this, pictures or icons represent the functions and tasks of the system. Even files are represented by icons, namely tiny sheets of paper containing the file names and directories are represented by pictures of folders. The contents of a directory appear in a box or window on the screen. Several directories can be displayed at the same time in different windows and files can be copied from one to another simply by selecting them with the mouse, keeping the button held down and dragging them to another window.

This kind of interface is called a graphical user interface, or GUI. The term WIMP is also used, meaning 'Window, Icon, Mouse, Pointer'.

Utilities

The third category of system software is utilities. These provide the following facilities.

- Carrying out tasks which are beyond the capabilities of the operating system.

- Carrying out operating system tasks in a more efficient and easier way.

Examples of utilities include Windows Explorer and programs that we run from control panel for setting the time and date, installing new hardware such as modem, scanner, changing mouse settings, changing display settings, WordPad, paintbrush, calculator, etc.

5.9 SUMMARY

A computer is an electronic data processing machine. We enter data and instructions into a computer and it processes the data according to the instructions (program) and produces the desired results.

A computer consists of five basic units, that is, arithmetic logic unit, control unit, memory unit, input unit and output unit. Arithmetic logic unit and control unit are combined into a single unit called the Central Processing Unit (CPU) which is the brain of the computer.

ARITHMETIC LOGIC UNIT

It is the part of the computer that performs all the calculations and comparisons. It performs these operations on binary numbers stored in the computer's memory and transfers the results back to the memory before it is send to the output unit. It consists of complex logic circuits such as adders, subtractors and comparators. Its operation is controlled by control unit.

CONTROL UNIT

It directs and coordinates the operation of the entire computer system by providing timing and control signals. It controls all the memory devices, arithmetic logic unit and all the input/output devices.

Control unit's function is to fetch, decode and execute the instructions that are stored in memory. The control unit contains complex logic and timing circuits that generate the signals needed to execute each instruction of a program one by one.

MAIN MEMORY

Main memory consists of two types, that is, Random Access Memory (RAM) and Read Only Memory (ROM).

RAM is used to store active programs and data. It requires fast read and write operations since its contents change continually when the computer executes a program. In RAM, any memory word is as easily accessible as any other. RAM consists of semiconductor IC chips. It is expensive but very fast memory. Its contents are lost when the computer is turned off.

ROM stores information permanently. ROMs can not have their data changed once they have been programmed. Like RAM, ROM also consists of IC chips. ROMs are used to store programs that are frequently required and are not to change during the operation of the computer. The programs stored in ROM are not lost when it is switched off.

INPUT UNIT

It is used to communicate with the computer. Data and instructions are entered into the computer through the input devices such as, keyboard, mouse, joystick and scanner.

OUTPUT UNIT

The purpose of output unit is to display or print the information stored in the main memory of the computer. Widely used output devices include monitor, printers and plotters.

BUSES

A bus is a group of parallel strands of wires for transmitting binary information. Some buses are unidirectional and some are bi-directional. There are three types of buses used in a computer system which are data bus, address bus and control bus.

Data bus is a bi-directional bus that transfers binary information from the microprocessor to memory or from the memory to the microprocessor.

Address bus carries address code from the microprocessor to the memory to select the memory location for a read or write operation. It is a unidirectional bus.

Control bus is a grouping of all the timing and control signals needed to synchronize the operation of the microprocessor with other units. It is a unidirectional bus.

MICROPROCESSOR REGISTERS

A register accepts binary information, stores it temporarily and passes on to another part of the computer. Registers serve as dedicated memory locations inside the microprocessor chip. The number of bits a register can store is known as register length.

Program Counter (PC): This register controls the sequence in which the instructions are fetched from memory. It indicates the address in memory from where the next instruction is to be fetched.

Data Address Register (DAR): It provides an operand address to the memory unit when the microprocessor has to access memory during the execution phase of an instruction.

Instruction Register (IR): After the fetch operation the IR holds the instruction while the instruction decoder circuits decode it.

Accumulator (A) and Data Register (DR): These two registers hold the operands that the ALU operates on during the execution of an instruction.

INSTRUCTION CODES

An instruction code is a group of bits that tells the computer to perform a specific operation. It is divided into parts each having its own meaning. The most important part of an instruction code is its operation code which is a group of bits that define such operations as add, subtract, multiply, divide, shift and complement. Operation code must consists of at least n bits for a given 2^n (or less) distinct operations. The operation specified by the operation code must be executed on some data stored in memory and/or processor register. Therefore, an instruction code must specify not only the operation but

also the register and/or the memory word where the operands are to be found, as well as the register or memory word where the result is to be stored. Memory words can be specified in instruction codes by their addresses. Processor register can be specified by assigning to the instruction another binary code of k bits that specifies one of 2^k registers. There are many ways of arranging the binary code of instructions and each computer has its own particular instruction code format. Instruction code formats are defined by computer designers who specify the architecture of the computer.

Computer instructions are normally stored in consecutive memory locations and are executed sequentially one at a time. The control unit reads an instruction from a specific address in memory and executes it. It then continues by reading the next instruction in sequence and executes it and so on.

SYSTEM SOFTWARE

System software can be divided into three categories, that is, operating system, operating environment and utilities.

Operating System

A computer's operating system enables it to carry out its disk filing and other operational tasks which include network operations, multi-tasking and multi-user operations.

Operating Environment

People find the old text-based DOS operating environment unfriendly and difficult to use preferring instead one that is graphics based. Hence, the operating environment software which sits on top of the operating system and presents us with an easy-to-use and friendly way of performing the tasks were introduced. These include Windows from Microsoft and the Apple Macintosh operating environments. These operating environments were introduced to make the interaction between people and computers more user-friendly. In this, icons represent the functions and tasks of the system. Even files and folders are represented by icons. Mouse is used to move the cursor on the screen a button at the front of the mouse is used for selecting files or software options. This kind of interface is called a Graphics User Interface or GUI. The term WIMP meaning 'Windows, Icon, Mouse, Pointer' is also used.

Utilities

Utilities provide the facilities to carry out tasks which are beyond the capabilities of the operating system in a more efficient and easier way. It includes Windows Explorer and programs that are run from control panel.

5.10 EXERCISE

1. Fill in the blanks.
   i) The function of ..... is to fetch, decode and execute the instructions stored in memory.
   ii) ..... is volatile memory which means that it will lose all stored information if power is turned off.
   iii) One of the main functions of programs stored in ..... is to make the computer ready for operations when it is turned on.
   iv) Input/Output devices are also known as ..... devices.
   v) Input/Output devices are used to ..... with the computer.
   vi) Program Counter contains the address of memory location from where the next instruction is to be fetched.
   vii) An ..... is a group of bits that tells the computer to perform a specific operation.
   viii) When the second part of an instruction code specifies the address of an operand, the instruction is said to have a .....

2. Compare today's modern microcomputers with the first digital computers of the 1940s.

3. What is the Central Processing Unit? Describe briefly.

4. Explain RAM and ROM.

5. What are the types of buses used in the computer circuits and what are their functions?

6. Define register and explain the purpose of the following registers in computer systems.
   i) Program Counter (PC)
   ii) Data Address Register (DAR)
   iii) Memory Address Register (MAR)
   iv) Instruction Register (IR)
   v) Accumulator and Data Register

7. Explain the three basic types of instruction code formats used in computers.

8. Define system software and explain its three categories.

9. Explain Input / Output devices.

CHAPTER 6

DATA PROTECTION AND COPYRIGHT

6.1 DATA BACKUP

This is the most important step for maintaining the security of important data. Very often many computer users have an unerring faith in computer storage media. There are regular instances of people entrusting their only copy of a thesis or dissertation to single floppy disk. It is a fact that all forms of magnetic media degrade over time and will ultimately fail. There is far less certainty as to when a disk will fail or what the consequences might be. Therefore, you should save your work regularly and not to the same storage device. Backup frequency depends upon how much data you have and how regularly it changes. As a guideline, if you could not bare to loose something, it is time to make a copy. Choosing an alternative location is eminently sensible or your backup will suffer the same demise as the original. Whatever else may happen, if your data is kept on a media other than the hard disk of your computer you will be able to recover it.

In academic environments where there is a great deal of exchanging data and a very mobile user population computer viruses are a very real danger. Data loss through virus infections is very common in school, colleges and universities.

Looking After the Hardware

Normally a new machine will be under warranty for a year after the date of purchase. After this warranty expires any hardware repairs are likely to be costly. Many of the companies selling computer systems offer extended warranty schemes which may be worth considering after careful investigation.

Looking After the Data

There are three basic ways of ensuring that even if the hardware fails, you will still be able to access your data.

1) Backup all data that is important to you. This is the most important step in securing your data. Keep more than one copy. Ensure that the backup data is free from corruption.

2) Run anti-virus software. Keep the software up-to-date. Test your hard disk, floppies and all backups regularly.

3) Where you are dealing with sensitive data, make sure that the data is password protected/encrypted and not readily available to malicious abuse.

6.2 VIRUSES AND ANTI-VIRUS ISSUES

Computer Virus

A computer virus is a small hidden program on a floppy disk or a hard disk. Just like a biological virus a computer virus can spread from computer to computer through an infected floppy disk or over a computer network and infect other computers. Viruses can cause different types of damages to computer programs, files and computer hardware itself.

How do viruses spread?

You can get a virus only by downloading or receiving a file, which is infected that you run on your computer. The different ways in which this can happen are mentioned below.

1) If you get an e-mail with a file attached to it (an executable program such as .exe or .com) that contains a virus and you download that file and run it, your computer will become infected.

2) If you download a file from the Internet that contains a virus and you run it, your computer will become infected.

3) Viruses are also transmitted by computer networks and by infected disks. Do not use someone else's floppy without first checking it for virus.

4) If you boot a computer with an infected floppy (boot virus), your computer will be infected.

How to protect your computer from viruses?

Take the following precautionary steps:

1) Never download and/or run an attached file on an e-mail from a stranger or from an unknown address. Be very cautious when downloading/running one from a friend. Most likely if they pass you a virus, they may not know about it.

2) Never have your e-mail program set to automatically run attached files. This is especially true for browsers or e-mail programs which automatically execute Microsoft Word after opening an e-mail. Turn off the option to execute any programs after receiving e-mail.

3) Never run an executable file you have just received without first running it through an updated anti-virus utility.

4) If your computer is on a network, make sure you have security steps in place to prevent unauthorized users putting files on your computer. Networks are ideal virus transmitters since they are accessed by many computers and there usually is a great deal of interaction between these computers.

5) Make sure you have got a good anti-virus program that is updated often from the company.

6) Take care in using floppy disks! The more computers a floppy has been used on, the better the chance of a virus infecting it. Always run floppies through an anti-virus program before using it and be extremely cautious when booting your computer from a floppy disk.

7) Keep your e-mail software updated. Software companies are always finding problems with their software and if they are good about it, will post patches to update your e-mail software. Continually check your software company's web site for updates to your e-mail software.

Anti-virus Software

The first step to check for virus infection, is to use a reliable virus checker. However, no matter how much they tell you how good they are, it is

recommended to use at least two of them. The more famous ones are given below.

Mcafee
Norton anti-virus
Dr. Solomon's anti-virus
Thunderbyte

After you have installed them, run them to see if they find a virus on your computer. If the scanner tells you that you have a virus, it can clean it. You should make a backup copy of all the infected files before cleaning them. You can then let the anti-virus clean the originals only, not the backups. After you have cleaned them, try running the programs, to see if they work. If they appear to be working well, then all is fine and you can delete the backups. If however, they are not working, then you should delete them and restore your backups. You should try other scanners to see if they can remove it. Scanners can usually remove some viruses that others cannot. If you cannot find anything that will remove it and you have an uninfected backup then you should re-install it. If you have not got any backups then you will have to wait a while for a new update of your anti-virus scanner so that they will be able to remove it. During this time, you should not run the infected program under any conditions. If the program is not important, you can always delete it. If you do not know what the file is used for, do not delete it.

What is Virus Hoax?

Virus hoaxes are false reports about non-existent viruses, often claiming to do impossible things. Some recipients occasionally believe a hoax to be a true virus warning and may take drastic action such as shutting down their network.

Typically, hoaxes are E-mails which describe a dangerous new undetectable virus, usually using bogus technical terms. Hoaxes often ask you to avoid reading or downloading E-mails that have a particular subject line. For instance, the Good Times hoax claims to put your computer's CPU in "an nth-complexity infinite binary loop which can severely damage the processor". The hoax warns you not to read or download anything with the subject "Good Times" because the message is a virus. It then urges you to forward the warning to as many people as possible.

Sometimes hoaxes can cost you even more than a genuine virus incident. After all, no anti-virus will detect hoaxes because they are not viruses. Some companies panic when they receive a hoax virus warning and assume the worst, making the situation much worse.

6.3 DATA PROTECTION AND PRIVACY ISSUES

Recently, people have been concerned that computers may be eroding people's privacy. Until recently, information on people was held on computers by various government and private organizations but there was no cross flow of information from one department to another. Now, because it is easier to pass data between terminals. It is possible to link together a number of different computers containing information about a private individual. This is very sinister implication and certain people are worried about the invasion of computers into people's privacy. In America, the private citizen has the right to view any information kept about him.

From the day a baby is born until the day she dies, information will be built up about her by various sources and stored on a computer. If she is born in a hospital, the first computer with information about her will belong to the hospital computer. Through out her life, information about her will be built up inside various computer memories.

It would be possible for computers to be used in what most people describe as sinister ways. For example, local health authorities could disclose the names of people who have bad eyesight to the police. The police could then look at lists of people who have had accidents but have told the police they had perfect eyesight. It would also be possible for the government to build up a complete picture of a person's life regarding personal details, income and how he spends it. There are endless possibilities for the exchange of information.

The problem with storing information on computers is that the information must be right. Quite often, wrong information goes into the computer, for example it may be typed wrongly. This can have severe consequences for the person concerned. Often, people are blacklisted by the credit referral agencies incorrectly. Then they find it impossible to buy any goods on credit.

There are safeguards against wrong information. The Consumer Credit Act requires all credit referral agencies to check and correct their records if someone has been blacklisted incorrectly.

The Data Protection Act

The Protection Act is an Act (law) passed by the government to protect the rights of the individuals against misuse of personal information by organizations that hold the information. The Data Protection Act passed by the British Parliament in 1984 covers four main areas:

1. All the computer systems, which process any personal data, must be registered with the Data Protection Registrar.

2. The personal data must not be disclosed to anyone outside the department that processes the data. For instance a cricket club could not supply a list of its members to a local sports shop.

3. The subjects of the data (the people about whom the information is about) have a right to see the information held about them. There are certain exceptions to this.

4. Individuals are given the right to compensation where they have suffered personal damage through inaccuracy or loss of personal data and they have the right to correct or erase data where applicable.

Records about people are kept on computers so that different authorities, organizations, etc. can make decisions which affect us, for good or for evil, employment, social work, payroll, pensions and so on. If there are any errors in such files then wrong action could follow which could lead to people being wrongly treated or suffering injustice. Therefore, people should be allowed to view this information to check that it is fair and correct.

The Eight Data Protection Principles

There are eight principles, which form part of the Data Protection Act. They require data to be:

1. Obtained fairly and lawfully.

2. Held only for one or more lawful purposes specified in the data user's register entry.

3. Used or disclosed only in accordance with the data user's register entry.

4. Adequate, relevant and not excessive for those purposes.

5. Accurate and where necessary, up-to-date.

6. Not kept longer than necessary for the specified purpose.

7. Made available to data subjects (i.e. the people to whom the data refers) on request.

8. Properly protected against loss or disclosure (i.e. passing the information on to someone else).

Exemptions from the Act

Some data is exempted from the Data Protection Act. For instance, personal details kept for the purpose of safeguarding national security are exempted. Medical and social service records are also exempted. Data held by Inland Revenue or the Customs and Excise which is used to help for collecting taxes is also exempted. Any data kept by the police for the prevention or detection of crime or for the apprehension/prosecution of offenders is also exempted.

Data of a less serious nature used for the management of personal, family or household use is also exempted. This means that if you hold personal details of all your friends on your home computer for the purpose of sending them New Year cards etc., then you do not have to register your use.

6.4 A HISTORICAL PERSPECTIVE OF COPYRIGHT

Copyright means that a person who expresses ideas, whether in literary, musical or artistic form, is the natural owner of the particular form in which the ideas are expressed and entitled to the exclusive rights conferred by legal title. Over time, forms of expression have expanded to include photography, film, sound recording or books.

The justification for recognizing ownership is two folds. The first moral that the person who expresses an idea naturally owns the expression of the idea. The second is economic that without the safeguards provided in work produced, an individual will lack incentive to engage in creative activity, assuming that he or she will not be able to profit from the outcome of that activity. Copyright prevents copying or replication of the relevant subject

matter by any person other than the owner. The reason that a right of successive replication was conferred exclusively on the owner was that the economic value of expressive works lay in potential sale of multiple units of the same work, for example a book.

The copyright law supplies the intellectual property rights on which the film, musical, literary, artistic and software industries rely. The copyright law is now undergoing substantial re-examination because of the economic and social changes caused by rapid development in computer technology.

What is Copyright?

Copyright is the branch of the law, which protects creative works from unauthorized use by other people. It allows creators to benefit financially from their works and to retain some control over how they are subsequently used.

The original creator(s) may own copyright or it may be assigned to another person. Bodies such as corporations will usually own the copyright in works created by their employees.

The categories of works that copyright protects include literary, dramatic, musical or artistic works. "Literary" includes all written materials from novels to lyrics to computer programs. Copyright also protects sound recording, films, television and sound broadcastings and books.

The owner of the copyright in a work has the right to publish, reproduce, broadcast or to perform in public.

What is Copyright Infringement?

Infringement of copyright can happen when works such as paintings, books, computer software, films and music are reproduced without permission from the copyright owners. Infringement can also occur when works such as plays and films are performed, screened or made public in other ways without permission from the copyright owner. A person who sells infringing versions of a work, even if somebody else made them, is also in breach of copyright. If a work is very distinctive and original, reproducing part of it may be a breach of copyright.

Criminal actions can be brought against people or organizations that infringe copyright. The type of action taken depends on the nature of infringement.

Criminal offences include the sale, importation or distribution of infringing reproductions. It is also a criminal offence to own equipment that is used to make infringing copies of copyright material to be sold.

There are exceptions to copyright that allow some people to make copies of works in certain instances without the permission of the copyright owners. For example, students can make copies for study purposes of single articles from journals or chapters from books. Other cases where copyright work is allowed include reproduction for criticism or review, reproduction for news reporting or computer programs are reproduced in making backups.

Computer Software and Copyright Law

You should be aware that under United States Copyright Law you have the right to make archival backups of your computer software, even if your license agreement states that you may not make copies for any reason. You should also be aware that you are obliged to obey the rest of the terms of the license agreement. United States law concludes that the terms of a shrink-wrap license agreement are generally valid.

A good application software package may take many programmers years to develop and can represent an investment of millions of dollars. This investment can only be recovered by selling the software to paying customers. When software is given away free, it makes it difficult for software creators to stay in business. This makes it improper to make copies of software and sell it. All of the above is an argument against pirating software, not against copying it. The fact is that to stay in business, you must have backups. Whenever the issue of copying comes into court, there is no difficulty in obtaining computer professionals to say that backup copies are essential. No case has come so far in which anyone who made backup copies got into trouble with the law. Cases have come in which pirates have been successfully prosecuted.

6.5 COMPUTER CRIME

Computer crime can be defined as any crime that is committed by means of the special knowledge or expert use of computer technology. Computer crime became a serious problem in the late 20th century. Since the first reported case of computer crime in 1958, computers have been involved in most types of crimes, including theft, burglary, larceny, fraud, embezzlement, extortion, sabotage, espionage, kidnapping and murder. Computer systems themselves

can be the targets of attack, as when a computer virus is surreptitiously introduced into a system to alter or destroy data. Breaking into private computer system to destroy, steal or alter information became easier once modems were introduced in the 1960s. Technically expert computer hobbyists who use personal computers and modems to break into and temper with computer systems are known as "*hackers*". Most serious computer crimes are committed in the banking and financial-service industries where money, credit and other financial assets are recorded in electronic databases and are transmitted as signals over telephone lines. Persons with access to such systems may falsify or manipulate these records for their own purposes by illegally transferring money balances to their own accounts.

For example, one employee programmed a computer to pay vast sums of money into a fictitious bank account. He also programmed it to return the money to its owner every time there was an audit (account check). All he stole was the interest. Some thieves in banks steal money held in dormant accounts. This is where someone has died and the account still has some money in it. There is no customer around to complain and people have got away with large amounts of money with the help of the computer. Quite often, the person who is caught is only dismissed and those who are prosecuted only receive comparatively light sentences.

6.6 SUMMARY

DATA BACKUP

All forms of magnetic media degrades over time and ultimately fails. Therefore, it is important to backup our work regularly to another storage device. This is the most important step for maintaining the security of important data. If your data is kept on a media other than the hard disk of your computer, you will be able to recover it in case you have hard disk failure or some other problem with it.

VIRUS AND ANTI-VIRUS ISSUES

A computer virus is a small hidden program on a floppy or hard disk which can spread from computer to computer through an infected floppy disk or over a computer network and infect other programs. It can also spread through an e-

mail with a file attached to it or when you download a file from the Internet that contains a virus.

Viruses can cause different types of damage to computer programs, files and computer hardware itself.

To protect your computer from viruses, install an anti-virus software on your computer and make sure that it is often updated from the company.

DATA PROCTECTION AND PRIVACY ISSUES

Many people are worried about the invasion of computers into their privacy. Information about people is stored on computers by various government and private organizations. It is possible for computer to be used in what most people describe as sinister ways. For example, disclosing information about an individual to some one without his permission can be harmful to the individual. Another problem with storing information on computers is that if the information on computers is wrong, this can have severe consequences for the person concerned. The data protection act (law) passed by many governments protect the rights of the individuals against misuse of personal information by the organization that holds the information.

A HISTORICAL PERSPECTIVE OF COPYRIGHT

Copyright means that a person who expresses ideas in any form is the owner of the particular form in which the ideas are expressed and entitled to the exclusive rights. Ideas can be expressed in the form of a book, sound recording, film or artistic form.

Copyright law prevents copying of the relevant subject matter by any person other than the owner. The reason for this is that the economic value of expressive works lay in sale of multiple units of the same work. For example, a book, a film or a software.

Copyright is the branch of law which protects creative works from unauthorized use by other people to allow creators to benefit financially from their work.. The categories of work that copyright protects include literary, dramatic, musical or artistic works. Literary includes all written material such

as novels, lyrics and computer software. It also protects broadcastings and books.

When works such as paintings, books, computer software, films and music are reproduced without permission from the copyright owner, this is called infringement of copyright. Criminal actions can be brought against people or organizations that infringe copyright.

Regarding computer software, you have the right to make backups of your computer software but you are not allowed to make copies for any other reason. A good application software package may take many programs years to develop and can cost millions of dollars. This investment can only be recovered by selling the software to customers.

COMPUTER CRIME

A crime committed by means of special knowledge or expert use of computer technology is known as computer crime. Computers have been involved in many types of crimes including, theft, burglary, larceny, fraud, kidnapping and murder. Computer systems themselves can also be the target of attack when a computer virus is surreptitiously introduced into a system to alter, steal or destroy data.

6.7 EXERCISE

1. Fill in the blanks.
   i) ..... is a small hidden program which can cause different types of damages to a computer.
   ii) ..... software is used to detect and remove viruses.
   iii) The branch of law which protects creative work from unauthorized use by other people is known as .....
   iv) When some creative work is reproduced without permission from the copyright owner, it is ..... of copyright.
   v) ..... is a false report about a non-existent virus.
   vi) ..... is the most important step for maintaining the security of important data.
   vii) ..... software means, making illegal copies of software and selling it.
   viii) Computer experts who use personal computers to break into and

temper with computer systems are known as .....

2. What is a computer virus and how it spreads and infects other computers?

3. Mention all the necessary steps you should take to protect your computer from viruses.

4. Compare virus hoax with a genuine computer virus.

5. Explain the data protection principles.

6. Write a note on the historical perspective of copyright.

7. What is copyright and what are the types of works that are protected by copyright.

8. What is copyright infringement? Mention the criminal offences related to copyright and its exception.

9. Write a note on computer software and copyright law.

10. Write a note on computer crime.

11. Why is it necessary to backup data regularly?

CHAPTER 7

WINDOWS OPERATING SYSTEM

As you learned in Chapter 1, operating systems are programs that allow computers to operate. They help control the flow of information from one part of the computer to another and serve as an intermediary between application programs and hardware. Learning at least a little bit about your operating system is essential step in learning to use your computer. In fact, the more you learn about the operating system, the more you will understand both your hardware and the application programs that use the operating system as their base.

Windows is the most widely used operating system for PCs. This chapter introduces the Windows environment and explains how to load application programs within Windows and how to use Windows to perform disk housekeeping operations such as copying, renaming and deleting files.

Because most PCs are now sold with Windows 98 pre-installed, it is assumed that Windows is already on your computer. Most of the material in this chapter will be applicable to Windows 95 also since Windows 95 is quite similar to Windows 98.

Windows is an operating environment created by Microsoft. It provides users of PCs with what is known as a Graphical User Interface (GUI), that is, an environment based largely on pictures, buttons and menu options on the screen rather than on typed commands such as the old DOS. For example if the user has to open the Microsoft Word for writing then he just has to double click the icon on the desk top and the program will start, whereas, in case of the dose environment the command is to be typed. Issuing orders in Windows programs is a matter of clicking pictures on the screen or making selections from menus (on screen list of options). If you forget how to perform a particular task, you can often refresh your memory simply by poking around on the screen and seeing which choices are available.

Most programs designed to run within Windows look and behave similarly. Windows application programs are populated with entities such as icons (pictures that represent data files, programs or folders), dialog boxes (frames

that display information and/or ask you questions) and windows (frames in which programs and data are displayed).

Almost all Windows programs also feature similar menu systems and at least a few of the same commands. For example, to leave most Windows applications, you choose the Exit option from a menu named File. After you have mastered one Windows program, it is fairly easy to learn the next.

7.1 IMPORTANT FEATURES OF WINDOWS

Running Several Programs Simultaneously

Windows also allows you to run multiple programs at once. If you are just getting started with computers, this feature may seem of limited value. Why should you want to run two programs at once when you are still feeling overwhelmed by the first one? After you get a little more comfortable with your system, however, you may find this feature useful.

Switching Between Open Applications

Imagine getting a phone call about your latest sales figures when you are in the middle of typing a letter in your word processing program. If you are using Windows, you can easily open your spreadsheet program and find the necessary information without leaving your word processing program. When you are done, a single mouse click or keystroke will take you back to your word processing document and you can pick up exactly where you left off.

Multitasking

Windows not only allows you to open two or more programs at once, it allows you to carry out work in both programs simultaneously. If you need to perform a time-consuming task in one program such as, copying a large file from the Internet, you simply start the process and then switch to a different program. The first task will continue unattended while you work in the second. This capability to work on two or more things at once is called multitasking. People perform multitask all the time, such as,reading while watching television, talking on the phone while cooking dinner, chewing gum while jogging, etc..

The Windows Clipboard

Windows also includes a feature known as the Clipboard that lets you easily copy or move data from one program to another and you can do this using the same Cut, Copy and Paste commands in almost all Windows programs. This means that you can copy those sales figures directly from your spreadsheet into your word processing document without having to use any special importing or exporting commands.

7.2 THE WINDOWS DESKTOP

After your computer finishes loading Windows into memory, you arrive at a screen known as the Windows desktop. The desktop is the workspace, the surface on which you spread out any file folders, programs and documents you want to use. Technically, the desktop is the area behind all the objects on the screen, including any windows that you open. No matter what you do in the Windows environment, you can always get back to the desktop even if you open an application program and expand it to fill the whole screen. Below the desktop you will most likely see a gray bar known as the taskbar which will be discussed later.

A typical Windows 98 desktop is populated with the little labeled pictures known as icons. When you double-click an icon, you open it up into the rectangular frame called a window. The icons that appear on your desktop when you start Windows provide quick access to the places on your computer that you visit most often. Desktop contains various types of icons.

Folder Icons

Folder icons open into folder windows which reveal the contents of particular folders in your computerized filing system.

Program Icons

Program icons open into application programs, that is, they load the associated programs into memory and start them running.

Document Icons

Document icons open into documents. When you double-click a document icon, Windows starts the application (word processing program, spreadsheet,

database or whatever) in which the document was created and then opens the document itself.

Shortcut Icons

Shortcut icons provide alternative entry-ways to programs, documents and folders. Shortcut icons always have arrows on them and their labels frequently contain the words "Shortcut to".

Special Icons

Your desktop may also contain a few specialized icons, including The Recycle Bin, which is discussed later in this chapter. The others are too specialized to be covered here.

7.3 THE TASK BAR

The Windows taskbar is a gray bar with the word "Start" at the left end. It is usually located at the bottom of the desktop but you can move it elsewhere. The taskbar is "Control central" for Windows. Unless you go out of your way to hide it, the taskbar usually stays on screen all the time, regardless of whether you are looking at the desktop or at an application program. It tells you which programs are currently running, which folder windows are open and in most cases what time it is. It also gives you access to a list of options known as the Start menu which you can use to launch programs, find files, activate the Windows Help system, change the way Windows behaves and shut down your computer.

The Start Button

The taskbar contains several sections. At the left edge is the Start button, which you can use to start up Windows applications, open documents, get help and much more.

The Quick Launch Toolbar

Immediately to the right of the Start button is the Quick Launch Toolbar. You can click the leftmost button to launch the Internet Explorer Browser. The button immediately to its right starts the Outlook Express program for sending and managing e-mail. The third button, Show Desktop, minimizes all open

programs so you can see the desktop. The rightmost button opens a full-screen window for viewing channels, with a channel bar on the left that lets you choose which channels to view.

Task Buttons

In the center section of the taskbar you will see one button for each program that your system is currently running and one for every folder that is currently open on your desktop. This collection of buttons (known as task buttons) not only provides a running status report on your working environment, it gives you a quick means of switching from one folder or application to the next. Whenever you click a task button, Windows immediately activates the associated window or program. You can click the task button a second time to minimize the window, you just activated.

The Tray

The rightmost section of the taskbar is called the tray. It usually contains a clock that displays the current time. To display the current date, hold the mouse pointer over the clock for a moment. You can change the time or date by double-clicking the clock. You can get rid of the clock altogether. To turn this feature on or off, right click the taskbar, select Properties and click the Auto-hide check box to add or remove the check mark. Then click OK to close the dialog box and put your change into effect. The tray can also hold icons for various utility programs, such as the program that handles your connection to the Internet or the program to handle the MS Messenger program.

7.4 WORKING WITH WINDOWS

You can expand, shrink, push, pull and rearrange windows to your heart's content. When you first open a window, it may occupy less than the entire screen or in the case of a document window, less than its entire application window. If so, you can maximize the window to make it larger. If you instead need the window to be smaller, you can restore it to its previous size. If you want to reduce the window to the size of a small button, you can also minimize it.

You can also fine-tune a window's size by dragging its border with the mouse. You can also use the mouse to change the location of non-maximized

windows. Finally, there are several simple ways of closing windows that you don't need to work with any longer.

Maximizing Windows

If you want more room to work in, you can expand the window as far as possible by clicking its Maximize button which looks like a tiny window with a title bar across the top. Maximizing a document window enlarges it so that it fills the entire application window and maximizing an application window enlarges it so that it fills the entire screen.

Restoring Windows

After you have maximized a window, the Maximize button itself is replaced by a Restore button which contains a picture of two overlapping windows. Clicking this button restores the window to its previous size, that is, the size it was just before you maximized it.

Minimizing Windows

To minimize a window, click its Minimize button. This is the button to the left of the Maximize/Restore button that looks like a little dash.

Minimizing and Restoring an Application

When you minimize an application window, it disappears from the screen but its task button remains on the taskbar. You can restore the window at any time by clicking once on this task button. You can minimize it once more by clicking its taskbar button a second time.

Moving Windows

You can move a window on the screen if it is not maximized by dragging its title bar with the mouse.

Resizing Windows

You also use mouse to resize a window if it is not maximized. Start by slowly moving the mouse pointer across the border until the pointer changes into a double-headed arrow. Then press the left mouse button and hold it down as

you drag the border of the window. When the window is the desired size. release the mouse button. If you want to change both the height and width of a window, drag one of its corners.

Closing Windows

To close a window, you can click the Close (x) button in the window's upper-right corner. You can close an application window by opening the File menu and selecting the last option. This option will be named Close if you are in a folder window, otherwise, it will be called Exit. You can close a document window by opening the File menu and choosing Close.

7.5 WORKING WITH MY COMPUTER

Folders are the building blocks of your computerized filing system. The desktop is the top or outermost layer of this system. It contains megafolders entitled My Computer which contains all the drives on your computer. Those megafolders contain folders for individual disk and CD-ROM drives. Those drive folders, in turn, contain file folders and individual files. The filing system can continue indefinitely, folders can contain folders, which can contain additional folders and so on.

My Computer folder serves as the point of entry into your computer's filing system. It is the first folder you will open and usually the last one you will close.

Opening a Folder Window

You can open a folder window by double-clicking a folder icon. If the folder you want is more than one level down in the folder hierarchy anywhere below the My Computer , you will need to open two or more folder windows to get there.

Parent and Child Windows

When you open one folder window from inside another, the first window often called the parent window remains open on the desktop, partially covered by the newly opened child window.

Folder Information

When you open a folder window, the left section of the status bar at the bottom of the window indicates the number of items in the window, the middle section indicates the amount of disk space occupied by those items. If you don't see the amount of disk space, increase the width of the window.

Closing All Related Folders

When you open a folder from within another folder window, the parent window normally remains open on the desktop, particularly if you burrow several levels down in the folder hierarchy. If you hold down the Shift key while you open a window's File menu and choose Close, Windows closes not only that window but all its "*ancestors*".

If you insert a disk or CD into a drive while a folder window for that drive is open, you need to select View and choose Refresh to see the contents of the newly inserted disk.

Creating a New Folder

You can create new folder by right-clicking a blank spot on the desktop or within a folder window and selecting New from the context menu. You can also open the folder window's File menu and select New, then Folder. Windows will create a new folder icon with the label New Folder. To rename the folder, type the name you want and press Enter.

7.6 RULES FOR FILE AND FOLDER NAMES

All files and folders must have names. These names should be chosen carefully. You will want to use names that are easy to remember and that are neither so short that they are cryptic nor so long that they are tedious to read or type. You also need to be sure that your files and folders names don't include any "*illegal*" character.

File-Naming Conventions

In Windows 98 and 95, the names you assign to files and folders can be up to 255 characters long. They can include spaces and periods. There are a few characters that file and folder names cannot include such as:

* | < > ? / " :

File Extensions

The names for most files include short last names known as extensions that are usually used to identify the file type. Extensions can be anywhere from one to three characters long. Programs that use extensions add them to your filenames automatically. If you name a file "*Letter to Manager*" in Word for Windows, for example, the full filename becomes *Letter to Manager.doc*. The period and doc extension are added by the program itself. Following are the examples of extensions that are created automatically by applications programs.

.doc
.xls
.pcx
.tif
.tmp

Windows maintains its own Registry of file types and the associated extensions. By default, Windows does not display any extension it recognizes. This means that even though your full filename is Letter to Manager.doc, it appears as Letter to Manager in folder and Explorer windows.

If you prefer to see the extensions, open the View menu and choose Folder Options. Select the View tab in the resulting dialog box, deselect the check box labeled Hide File Extensions for Known File Types and click OK. This change applies to all folders and Explorer windows, not just the one that is active at the moment.

DOS Filenames

To see the DOS filename for a file, right click the file icon and select Properties. Windows displays a Properties dialog box. If necessary, click the General tab. You will see information on the file, including its type, location, size, the dates on which it was created, last modified and last accessed and its MS DOS filename. It also contains information about file attributes which you don't need to worry about at this point.

Windows 98 and 95 actually keep track of two filenames for every file, the filename you assign and a DOS-compatible version called MS DOS filename that windows creates for you. If your Windows filename is eight characters or less and does not contain any spaces, the two filenames will be identical. If you give copies of your files to people who are using DOS or an older version of Windows, such as Windows 3.1, they will need to use the MS-DOS filenames when opening the files.

7.7 CHANGING YOUR VIEW OF FOLDER WINDOW

Windows provides four ways of representing the items in a folder window. By default, the items in a folder window are displayed in what's known as the Large Icons view. You can change to a different view, using the View option on the window's menu bar. In the View menu, you will see options for Large Icons, Small Icons, List and Details.

Large Icon View

In Large Icon view, each drive, folder or file is shown as a large icon with a name or description underneath.

Small Icons View

In Small Icon view, each drive, folder or file is shown as a small icon with a name or description to its right. In this view, the items are arranged horizontally.

List View

List view is just like Small Icons view but the icons are arranged vertically rather than horizontally.

Details View

Details view gives you more information, displaying not only item names but also each item's size, type (folder or file type) and the date each item was last modified. You can change column widths in Details view by dragging the borders between the column headings.

7.8 SELECTING, RENAMING AND DELETING FILES AND FOLDERS

The more you use your computer, the more files and folders you are likely to accumulate. Learning to handle these files and folders is an essential part of using your computer well. There are actually two environments in which you can carry out file system maintenance in Windows. For now, we will focus on using folder windows. Later, you will learn to perform the same operations using the Windows Explorer.

Find Your File

The first step in manipulating a file or folder using folder window is to drill down through the folder hierarchy until you reach the window that contains the associated icon.

Select Your File

Next, select the file or folder. To select one item, just click its name or icon. The selected item will be highlighted in a different color.

Selecting by Dragging

You can select several adjacent items by dragging. Move the mouse pointer to a spot slightly above and to the left of the group of items and then drag to a point just below and to the right of the items. As you drag, Windows displays a dotted rectangle around the group of items. As soon as you release the mouse button, all the items inside the rectangle become selected. And no matter which window style you are using make sure that you are not pointing directly at a file or folder when you begin to drag.

Selecting Multiple Files

To select multiple items, click one and then hold down Ctrl while you click others. If single items you want to select are contiguous an easy way to select them is to click the first (highest or leftmost) one you want to select and then hold down Shift while you click the last (lowest or rightmost) or vice versa.

Selecting Everything

To select everything in the window, choose Edit from the menu bar and then choose Select All or you can press Ctrl+A.

Renaming Files and Folders

You can rename a file or folder by right clicking the icon and choosing Rename. Then type in the desired name. You can also click the file or folder's label once to select it and a second time to display an insertion point inside the label. Be sure not to click too quickly. If Windows interprets your action as a double-click, it will open the file or folder. Now you can type the new filename. Note: F2 is a shortcut for renaming.

Deleting Files

To delete one or more files, start by selecting the items and then press Del, drag them to the Recycle Bin icon on your desktop, or issue the File, Delete command. Windows asks you to confirm that you want to send the items to the Recycle Bin. Click Yes to go ahead and do so.

7.9 COPYING AND MOVING FILES AND FOLDERS

This section describes how to copy and move files using menus and using a mouse technique called drag and drop.

Select the Items

The easiest and safest method to copy or move selected files or folders involves four steps. The first step is to select the items you want to copy or move in a folder window. If you want to copy files from a floppy disk, insert the disk in the drive, open a folder window for My Computer, double-click the icon for your floppy disk drive and select the desired files.

Cut or Copy

Second, issue a command to "cut" the items if you plan to move them or "copy" them if you plan to make duplicates. You can do this either by opening the Edit menu and choosing Cut for moving or Copy for copying or by using accelerator keys. Ctrl+X cuts the selected items and Ctrl+C copies them. You

can also just right-click the selected item and choose Cut or Copy from its context menu. If more than one item is selected, right-click any one of them. Or , you can use the Cut and Copy buttons that now appear in folder windows. When you cut items, the icons don't disappear right away, their outline becomes dotted. As soon as you paste the items in their new location, these ghostlike icons disappear.

Open the Destination Folder

Third, open a folder window for the folder into which you want to copy the items.

Paste Them in

Finally, either right-click a blank spot within the window and choose Paste from the context menu or open the Edit menu again and choose Paste or use Ctrl+V. You can also use the Paste toolbar button. You will immediately see the items you pasted appear in the window. Alternatively, you can locate the icon for the folder into which you want to copy or move the items, right-click the icon itself and choose Paste from the context menu.

Copying to a Floppy

If you want to copy files from your hard drive to a floppy drive, there is an easier method. Select icons for the files you want to copy. Right-click any one of the selected icons and choose Send To. When Windows displays a menu of places you can direct the files to, choose the floppy drive option.

Moving or Copying with Drag and Drop

You can also move and copy items between folders using a feature known as drag and drop, that is, by using your mouse to drag selected items form one folder to another. It is safer to drag using the right mouse button rather than the left. That way, when you release the mouse button, Windows asks whether you want to copy or move the selected items. If you drag using the left mouse button, Windows decides whether you intend to copy or move depending on whether you are dragging between folders on the same disk or on different disks.

If you drag something to the wrong place by accident, right-click a blank spot in the folder window or on the desktop and choose Undo Move.

7.10 USING THE RECYCLE BIN

The Recycle Bin icon on your desktop is a folder icon. When you select one or more files or folders and either press Del or drag those items to the Recycle Bin icon, windows does not actually erase them. It simply stores them in the Recycle Bin folder. You can open this folder and retrieve some or all of the items you previously recycled. If you decide you really do want to delete the files and retrieve the space they occupy on your hard disk, you can empty the Recycle Bin.

What is Stored in the Recycle Bin

When you delete items from your hard disk by selecting them and pressing Del, by dragging them to the Recycle Bin or by right-clicking them and choosing Delete, you will see a message asking whether you want to send the item or items to the Recycle Bin. Items deleted from floppy disk are not stored in the Recycle Bin.

Finding Items in the Recycle Bin

To retrieve items from the Recycle Bin, first double-click the Recycle Bin icon to open it into a folder window. This window is just like other folder windows except that it includes files selected for deletion.

Restoring Files from the Recycle Bin

To recover an item from the Recycle Bin, select it, open the File menu and choose restore. Alternatively, you can right-click the item and choose Restore from the context menu. This puts the file back where it was when you deleted it.

Deleting/Restoring Folders

If you delete a folder, Windows moves the entire folder to the Recycle Bin. When you look in the Recycle Bin, you won't see any of the individual files the folder contains, you will just see the folder itself. If you restore the folder, by choosing Restore from the File menu, Windows reinstates the folder plus its entire contents. If you just want to retain part of the folder's contents, then you will need to delete individually the items you don't want to keep.

Emptying the Recycle Bin

If you are running low on disk space, you may want to empty the Recycle Bin by right-clicking the Recycle Bin icon and choosing Empty Recycle Bin from the context menu. If you are already in the Recycle Bin window, choose Empty Recycle Bin from the File menu. You might also empty the Recycle Bin if you want to make sure no one can easily retrieve some of the items inside.

How Big Is the Recycle bin?

By default, Windows lets you keep adding items to the Recycle Bin until it's full. By default Recycle Bin is considered full when it consumes 10 % of the space on the hard disk on which Windows was installed. Then Windows automatically empties the Recycle Bin, freeing up that space on your hard disk for reuse.

7.11 DEALING WITH DISKS IN WINDOWS

Although most disks now come preformatted, you might occasionally need to format an unformatted disk or reformat a disk. You might reformat a disk either to erase all its files or to make it usable again if your computer is having hard time reading it because one or more if its files have been damaged.

Formatting a Floppy Disk

To format a disk, place the disk in the drive, double-click the My Computer icon, right-click the icon for your floppy disk drive and select Format from the context menu.

The Quick Formatting Option

When the Format dialog box appears, it offers three levels of formatting. The quick option is for erasing disks that have already been formatted. It provides a fast way of erasing all the files on a disk at once. This approach is a little easier than opening a folder for the disk, selecting all its contents and then pressing Del.

The Full Formatting Option

The Full option is for formatting unformatted disks and disks that your disk drive is having trouble reading.

Creating a Boot Disk

The Copy System Files Only option turns a disk that is already been formatted into a boot disk. A boot disk is used to boot up your computer if there is a problem on your hard disk. You will rarely use this option.

7.12 EXPLORING WINDOWS EXPLORER

Windows Explorer is a utility program that is part of Windows. You can accomplish the same tasks in Explorer as you do in folder windows, that is, running programs, opening documents and copying, moving, deleting and renaming folders and files. The main advantage of using Explorer is that it features a graphical representation of your computer's filing system. Some people find this representation a little confusing or overwhelming at first. After you get used to it, however, you will discover that it provides a useful and coherent overview of the folder hierarchy. By giving you big picture, Explorer makes it easier for you to see what is where and how to navigate from one location to the next.

Running Explorer

To run Explorer, either click the Start button, highlight Programs and then choose Windows Explorer or right-click the Start button and choose Explorer from the resulting context menu. In either case, you will see a window with the word "*Explorer*" in the tittle bar. Unlike most other windows you encounter in Windows programs, the Explorer window is divided into two sides or panes. The left pane contains the diagram of your folder hierarchy, the right pane looks much like a folder window.

The Folder Structure

When you start Explorer, you will see four levels in the folder hierarchy, the desktop itself, the folders and other icons on the desktop such as, My Computer and the Recycle Bin, subfolders of the folders on the desktop and subfolders of the subfolders of the folders on the desktop.

Expanding and Contracting the Folder Hierarchy

You can expand and contract levels by clicking the plus and minus sign that appear next to some of the icons. Any icon that contains additional folders not currently shown in the hierarchy will be preceded by a plus sign. Clicking the plus sign reveals the folders inside. Any icon preceded by minus sign has already been expanded to reveal its contents. You can contract it (hide its contents) by clicking the minus sign. Icons that have neither a plus sign nor a minus sign don't contain any additional folders.

Explorer's Right Pane

The right pane of the Explorer window shows the contents of the currently selected folder. The selected folder is highlighted in the folder hierarchy and its name appears in the window's title bar. As soon as you select a different folder in the left pane, the contents of the right pane change to reflect that folder's contents.

Explorer's Left Pane

When you select a folder in the left pane, the status bar at the bottom of the Explorer window tells you the number of items in the currently selected folder, the amount of disk space occupied by those items and the amount of free disk space left on the disk where that folder resides. It displays the same information when you select one or more items in the right pane.

Moving Through the Explorer Window

Each pane has its own scrollbar if it contains too much material to display all at once. You can also click somewhere in the pane to select it and then press the PgDn or PgUp key to move down or up a window at a time. In addition, you can press the End key to move to the bottom of the list and Home to move back to the top.

Opening Files and Folders in Explorer

To open files or folders within Explorer, double-click them. To run programs from Explorer, you first need to track down the **.exe** file for the program. If you don't see the file extensions, it is easy to turn them on as described early. When you find the file, double-click it.

7.13 COPYING AND MOVING ITEMS IN EXPLORER

Windows Explorer is an excellent environment for copying and moving files and folders. The procedure is almost identical to the one you use for copying or moving items between folder windows. In explorer, however, you have the advantage of seeing the entire folder hierarchy, so it is easier to visualize where you are copying things from and to.

Select the Folder and the Items to be Copied or Moved

To copy or move files, in the left pane, select the folder that contains the items you want to manipulate. In the right pane, select the items themselves.

To Copy or Move Items

If you want to copy the selected items, issue the Edit, Copy command or right-click one of the selected items and choose Copy from the context menu. If you want to move rather than copy the items, issue the Edit, Cut command or right-click one of the selected items and choose Cut from the context menu. You can also click the Copy or Cut toolbar button to copy or cut the selected items.

Find the Destination Folder

Scroll the folder hierarchy in the left pane until you can see the folder into which you want to copy the files. Expand any folder you need to. Select the folder and then select Paste from the Edit menu, right-click that folder and select Paste or press the Paste toolbar button.

Copying Files to a Floppy Disk

To copy files from your hard drive to a floppy disk, just select icons for the files you want to copy. Then right-click any one of the selected icons and choose Send To. When Windows displays a menu of places to send the files, select for your floppy disk drive.

Copying with Drag and Drop

You can also copy or move items using drag and drop. To do this, select the items you want to copy or move from the right pane. If necessary, scroll the folder hierarchy in the left pane until the folder into which you want to paste

the items is visible. Then right-drag any one of the selected items from the right pane to the desired destination folder in the left pane. Release the mouse button and when you see the context menu, specify whether you want to copy or move the items.

7.14 FINDING FILES IN WINDOWS

It is easy to locate a particular file in either a folder window or Explorer when you remember where you put the file in the first place. However, even the most organized Windows user will occasionally misplace a file. When all you know is that your file is "*out there somewhere*," you use Windows Find command. The Find command lets you locate documents, programs and folders anywhere on your computer. When you use the Find command, you can look for files by their names, content or location, the date they were created, last modified or last accessed, their file type or size or any combination of these attributes.

Finding Files by Name

Choose Find from the Start menu and then choose Files or Folders. You will see a Find dialog box. When you use the Find command, you will probably be looking up files by name. To do this, make sure the Name & Location tab is selected and type the file name in the Named box.

Using Wildcards

If you know only part of the name or want to look for a group of files with similar names, you can use wildcard characters. An asterisk stands for any number of characters and a question mark stands for any single character. For example, to specify all the files that start with the character "**lb**" and have an extension of **.doc**, you would enter **lb*.doc**. To search for files named **inv** followed by a single character only, enter **inv?.**

Searching for Text Strings

If you are not sure of the filename, another approach is to search for some text that you know the file contains. To do this, enter the word or phrase in the text box labeled Containing Text. If you enter more than one word, Windows looks for exactly those words in exactly that order.

Searching a Different Location

When you choose Find from the Start menu, Windows assumes that you want to look on the disk that contains your Windows system files. If you would like Windows to search elsewhere, you can select a different drive form the Look in drop-down list box. If you want to search a more specific location, you can also click the Browse button. This opens the Browse for Folder dialog box, in which you can hunt for the folder in which you want to conduct the search.

Searching by Date

To search for a file based on the date it was created, last modified or last accessed, click the Date tab. First select the Find All Files option button. In the drop-down list to its right, choose whether to search based on when the file was modified, created or last accessed. Then choose whether you want to find files that fall between two specific dates, during a designated number of previous months or during a designed number of previous days.

Searching by File Type or Size

To search for a file by its file type or size, select the Advanced tab in the Find dialog box. Choose a file type from the Of Type drop-down list. In the first drop-down list box to the right of Size Is, choose whether you want to select files that are At Least or At Most a particular size. In the next drop down list, specify a size in kilobytes.

Carrying out the Search

After you have typed all your search criteria, start the search by clicking the Find Now button on the right side of the Find dialog box. Windows will list any files or folders that match your criteria at the bottom of the dialog box. If the search is taking too long or if you decide to revise your criteria midstream, you can stop the search by clicking the Stop button at the right edge of the dialog.

7.15 GETTING HELP

Windows features a very extensive and easy to use Help system, a series of information screens and a set of tools for navigating them and finding the information you need. Not only is there a Help system for Windows itself,

most Windows programs have Help systems of their own which function in much the same way as Windows Help.

Getting Help

To get help, open the Start menu and select Help or open the Help menu in any folder window or Explorer window and choose Help Topics. To get help with an application program, select the Help option on the application window's menu bar.

The Three Tabs in the Windows Help Dialog Box

The Windows Help dialog box you see when you first enter the Windows Help system has three tabs:

- Contents presents information on general topics in outline form. It is the place to start when you need information on a broad topic, like using the Help system or printing.

- Index features more specific topics, listed in alphabetical order and lets you look up information by topic.

- Search lets you search for particular words or phrases within a help topic.

The Two Frames in the Windows Help Dialog Box

The Windows Help dialog box is divided into two frames. In the contents tab, the left frame shows lists of topics, in the Index tab it shows an index of topics, in the Search tab it lets you type in keywords and select topics. The right frame shows the text of selected help topic.

The Contents Tab

Information in the Contents tab is arranged like the table of contents in a book. Question mark icons always represent topics that you can display, book icons represent headings that you can expand or collapse, revealing or hiding subtopics. To display a topic or expand a heading, double-click the appropriate icon. Sometimes expanding one heading leads to more detailed headings.

The Index Tab

To use the Index tab, just start typing the first few characters of the word or words you want to know about. As soon as, you start, Windows begins displaying topics in the list area below your entry. When you see a topic you want to explore, double-click it

The Topics Found Dialog Box

If there are several Help topics associated with the item you double-click on, Windows displays the Topics Found dialog box. Double-click the topic you want to read about or click once and click the display button

The Search Tab

You use the Search tab to search for words or phrases contained within a Help topic. To use the Search tab, type a keyword or phrase in the text box at the top of the dialog box. Then click the List Topics button. If you see the topic you want on the list of topics, double-click it or click it once and then click the display button.

7.16 CUSTOMIZING WINDOWS

One of the satisfying things about Windows is that you can customize it to suit your fancy. You can change the look of the desktop by adding wallpaper or pattern or changing the color scheme. You can also use the Control Panel to adjust your system to meet your needs, such as, adjusting mouse click speed, monitor resolution and much more.

Changing the Way Windows Looks

Windows provides some simple tools for dressing up your desktop and changing the Windows color scheme. To customize the desktop, right-click an empty spot on the desktop and choose Properties to invoke the Display Properties dialog box.

Setting Your Wallpaper

From the Background page tab of the Display Properties dialog box, the Wallpaper list lets you select a graphic. Using the Display drop-down list, you can either tile (repeat across the desktop), center or stretch (expand to fill the

desktop) the selected graphics. Use the pattern list to choose a geometric pattern to fill the desktop.

Changing the Color Scheme

To change the color scheme, right-click an empty spot on the desktop, choose Properties and select the Appearance tab in the Display Properties dialog box. Click the arrow at the right edge of the Scheme drop-down list to display a list of color schemes. As soon as you pick one, Windows displays a sample in the upper half of the dialog box. When you have located a scheme that you like, click OK to close the dialog box and put your new scheme into effect.

What Is the Control Panel?

You can also make use of the Windows Control Panel to modify your system to suit your needs. The Control Panel is a special folder that contains tools for customizing the Windows environment. You can use these utilities to do everything from adjusting the speed at which your mouse moves across the screen, to resetting the date and time, to adding new hardware or software to your system. To access the Control Panel, click the Start button, select Settings and choose Control Panel.

Using the Control Panel

After you are in the Control Panel folder, double-click the appropriate icon. For example, double-click the Mouse icon if you want to modify your mouse settings. Feel free to explore the various tools, you can always come out by either closing the resulting folder window or clicking Cancel button.

7.17 SHUTTING DOWN OR RESTARTING WINDOWS

You need to exit from Windows properly before you turn off your computer. In addition, in some cases you may want to restart your computer. For example, if you have just installed a new program.

Before you turn off your computer, you should always open the Start menu and choose Shut Down. Since Shut Down is selected, just click OK or press Enter. If you have choose another option the last time you were in this dialog box, it will be selected instead. If so, just click the Shut Down option button to select it before clicking OK.

7.18 USING PRINTER

The first thing to know about selecting printers in Windows is that there is always one device designated as the default printer. This is the device to which Windows directs print output unless you specifically request otherwise.

Selecting a Different Printer

To direct print output somewhere else other than the default printer, you select Print from the File menu inside your application and then, in the Print dialog box, select a different printer in the Name drop-down list.

The printer you select will become the default for the current work session only. Windows assumes you want to print to this printer unless you specify otherwise, up until you leave the application. As soon as you close the application or load another program, Windows resumes printing to the designated default printer.

Changing the Default Printer

To designate a different printer as the default printer, right-click the icon for that printer in the Printer folder and choose Set As Default. The specified printer becomes the default printer for all your Windows applications.

Adding a Printer

What if you want to choose a new printer but it does not appear in the Name drop-down list in the Print dialog box? In this case, you need to add the printer to the list. To do this, use the Add Printer Wizard which you open by double-clicking Add Printer in the Printers folder under My Computer. The wizard asks you a series of questions about your new printer. You may also be asked to insert your Windows disk or a disk that came with your printer.

Checking the Print Queue

You can check the status of a printer's print queue by double-clicking the printer icon in the tray on the far right-hand side of the taskbar. You can also double-click the printer's icon in the Printers folder or if you have a shortcut for the printer on your desktop, by double-clicking the shortcut. Windows displays a list of all the documents in the queue in the order in which they will be printed and the amount still left to print.

Canceling a Print Job

To remove a single document from the queue, select it and then choose Cancel Printing from the Document menu. If the Windows was in the midst of printing the canceled document, this will effectively stop it. If there are other documents in the queue, Windows will move on to printing them.

Purging Documents from the Print Queue

To remove the documents from the queue, choose the Purge Print Documents option from the Printer menu. You can also purge all print jobs without opening the print queue, by right-clicking the printer's icon and choosing Purge Print Documents from the context menu.

7.19 SUMMARY

Windows is the most widely used operating system of PCs. It was developed by Microsoft. It provides a user-friendly Graphical User Interface (GUI). A GUI is based on pictures, buttons and menu options. It is very easy for the user to issue commands in Windows. The user simply has to click icons on the screen or make selections from menus. Icons are pictures that represent data files, programs or folders.

IMPORTANT FEATURES OF WINDOWS

Windows allows to run multiple programs at once and you can easily switch between open applications just by a single mouse click. It not only allows to open two or more windows to open more than one program it also allows you to carry out work in both programs simultaneously. Windows clipboard feature lets you easily copy or move data from one program to another and you can do this using the same Cut, Copy and Paste commands in almost all Windows programs.

THE WINDOWS DESKTOP

When you turn on your computer the first screen you arrive at is known as Windows desktop. Windows desktop contains folders, programs, documents and shortcut icons. It also contains few special icons such as The Recycle Bin.

Folder icons open into folder windows and display the contents of a particular folder. Program icons load the associated programs into memory and start them running. When you double-click a document icon, Windows starts the application in which the document was created and then opens the document. Shortcut icons always have arrows on them and provide alternative entry-ways to programs, documents and folders.

THE TASK BAR

The Windows taskbar is a grey bar with the word "start" at the left end. It is used to start up Windows applications, open documents, get help, etc.

Immediately to the right of Start button is the Quick Launch Toolbar which contains buttons to run the Internet Explorer browser, Outlook Express, Show Desktop and the right most button opens a full-screen window for viewing channels.

In the center section of the taskbar, you will see a button for each program that is currently running and one for every folder that is currently open. These buttons give you a quick means of switching from one folder or application to another.

The right most section is called the tray. It usually contains a clock that displays the current time. The tray can also contain icons for various utility programs such as Internet connection or MSN Messenger program icon.

WORKING WITH WINDOWS

Buttons at the top right corner of a window allow you to expand, shrink and minimize the window. You can also resize a window by dragging its border with the mouse. To close a window, you click the Close (x) button in the window's upper right corner. You can also close a window by opening the File menu and selecting the last option.

WORKING WITH MY COMPUTER

My computer folder serves as the point of entry into the filing system of your computer. It is the first folder you will open and usually the last one you will

close. It contains all the drives on your computer. These drive folders contain file folders and individual files. The filing system can continue indefinitely, folders can contain folders which can contain additional folders and so on.

RULES FOR FILE AND FOLDER NAMES

In Windows, files and folders can have names up to 255 characters long. There are a few characters that file and folder names cannot include such as

* | < > ? / " ;

File extension is used to identify the file type. Extension can be anywhere from one to three characters long. Following are the examples of extensions that are automatically created by application programs.

.doc .xlc .tif .tmp

CHANGING YOUR VIEW OF FOLDER WINDOW

Items in a folder window can be represented in four ways. By default, they are displayed in Large Icons view. You can change it by using the View option on the Window's menu bar. In the View menu, you can have four options, that is, Large Icons, Small Icons, List and Details. In Small Icons view, each drive, folder or file is shown as a small icon arranged horizontally. List view also displays items as small icons but arranged vertically. Details view gives more information about an item in a folder.

SELECTION, RENAMING AND DELETING FILES AND FOLDERS

To select an item in a folder, just click its name or icon. To select several adjacent items, move the mouse pointer to a spot slightly above and to the left of the group of items and then drag to a point just below and to the right of the items. As soon as you release the mouse button, all the items inside the rectangle become selected. To select multiple items, click one and then hold down Ctrl key while you click others. To select everything in the window, choose Edit from the menu bar and then choose Select All or you can press Ctrl and A keys simultaneously.

You can rename a file or folder name by right clicking the icon and choosing Rename. Now you can type the new name.

To delete one or more files, start by selecting the items and then press Del or issue the File, Delete command.

COPYING AND MOVING FILES AND FOLDERS

The first step to copy or move an item is to select it. Secondly, open the Edit menu and choose Cut for moving or Copy for copying. You can also right-click the selected item and choose Cut or Copy from its context menu. If more than one item is selected, right-click any one of them. Third, open a folder window where you want to move or copy the items. Finally, either right-click a blank spot within the window and choose Paste from the context menu or open the Edit menu and choose Paste.

To copy files from hard disk to floppy drive, select the items first and then right-click any one of them and choose Send To. When Windows displays a menu of places you can direct the files to, choose the floppy drive option.

USING THE RECYCLE BIN

When we delete one or more files or folders from hard disk, they are not actually erased they are transferred to a folder called Recycle Bin on the desktop.

You can restore files or folders in the Recycle Bin. To do this, open this folder and select the file or folder and right-click and select Restore.

You can also empty the Recycle Bin by right-clicking the Recycle Bin icon and choosing Empty Recycle Bin from the context menu.

DEALING WITH DISKS IN WINDOWS

To format a floppy disk, double-click the My Computer icon and then right-click the icon for your floppy disk and select Format from the menu. You can also select Quick option which provides a fast way of erasing all the files on a disk at once. The Full option is for formatting unformatted disks and disks that your disk drive is having trouble reading.

EXPLORING WINDOWS EXPLORER

Windows Explorer is a utility program to accomplish the same tasks as you do in folder windows. These tasks include running programs, opening documents and copying, moving, deleting and renaming folders and files. The advantage of using Explorer is that it presents a graphical picture of your computer's filing system and makes it easier to see what is where and how to navigate from one location to the next. To run Explorer, either click the Start button, highlight Programs and then choose Windows Explorer or right-click the Start button and choose Explorer from the context menu.

COPYING AND MOVING ITEMS IN EXPLORER

Windows Explorer provides a much easier way for copying and moving files and folders compared to the folder window method. The procedure is almost the same to the one used for copying and moving items between folder windows. However, in Explorer you have the advantage of seeing the entire folder structure which makes it easier to visualize where you are copying things from and to.

FINDING FILES IN WINDOWS

Windows Find command lets you locate documents, programs and folders anywhere on your computer. When you use the Find command, you can look for files by their names, content or location, the date they were created, last modified or last accessed date, their file type or size or any combination of these attributes.

Choose Find from the Start menu and then choose File or Folders. You will see a kind of dialog box. Make sure the Name & Location tab is selected and type the name in the Named box. To specify all the files that have the extension .doc, you would enter *.doc. To search for files that start with the letters inv, you would enter inv*.*.

After you have typed all your search criteria, start the search by clicking Find Now button on the right side of the Find dialog box. Windows will list any files or folders that match your criteria at the bottom of the dialog box.

GETTING HELP

Windows provides a very powerful help system. To get help, open the Start menu and select Help or open the Help menu in any folder window or Explorer window and choose Help Topics. You will see three tabs. These include Contents, Index and Search tabs. The Contents present information on general topics in outline form and is preferred to use when you need information on a broad topic. Index features more specific topics in alphabetical order and lets you look up information by topic. The search tab is used to search for words or phrases contained within help topics.

CUSTOMIZING WINDOWS

You can customize Windows according to your needs. You can change your d· ɔktop and Windows color scheme. Right-click an empty spot on the desktop and choose Properties and invoke the Display Properties dialog box. Options of this dialog box will let you customize the desktop and Windows color scheme.

You can also use the Windows Control Panel to change the settings of your system to suit your needs. The Control Panel is a special folder that contains tools for customizing the Windows environment such as resetting the date and time, adding new hardware or software to your system and changing the speed of mouse. To access the Control Panel, click the Start button and select Settings and choose Control Panel.

SHUTTING DOWN OR RESTARTING WINDOWS

Always open the Start menu and choose the Shut Down option to properly turn off your computer or choose restart if you want to restart your computer.

USING PRINTER

Windows designates a default printer to which it directs print output unless you specifically choose another printer. To direct output to a printer other than the default printer, you have to select Print from the File menu inside your application program and then in the Print dialog box, select a different printer from the Name drop-down list. The printer you select will become the default

printer for the current session. To designate another printer as default, right-click the icon for that printer in the Printers folder and choose Set As Default. To add a new printer in Name drop-down list in the Print dialog box, use the Add Printer wizard which you open by double-clicking Add Printer folder.

7.20 EXERCISE

1. Fill in the blanks.
   i) The capability of an operating system to run two or more programs at once is called .....
   ii) ..... feature of Windows lets you easily copy or move data from one program to another.
   iii) After Windows is loaded in your computer, the first screen you arrive at is known as the .....
   iv) Windows stores deleted items in a folder called .....
   v) A ..... disk is used to start up your computer if there is a problem on your hard disk.
   vi) You can accomplish the same tasks in ..... as you do in folder windows.
   vii) The ..... is a special folder that contains tools for customizing the Windows environment.
   viii) You can select all the items in a window by pressing.....

2. Compare the Windows operating system to the text-based Disk Operating System (DOS).

3. Explain the important features of Windows operating system.

4. Explain how to select, rename and delete files and folders in Windows.

5. Explain how Recycle Bin is used.

6. Explain how Windows is customized.

7. What type of jobs can be performed using Windows Explorer? Explain its folder structure, expanding and contracting the folder hierarchy, right and left pane and opening files and folders.

8. Explain how you are going to find a particular file in Windows.

9. Why do you think people should learn the Windows operating system before using application programs?

10. What is the importance of learning how to install Windows operating system on a microcomputer?

CHAPTER 8

WORD PROCESSING

At its simplest, word processing on a computer is just electronic typing. Instead of pressing keys on a typewriter, you press keys on a computer keyboard that looks much like a typewriter. But there is one essential difference. In word processing, the process of composing a document is separate from the process of printing. For many people, the separation between composing a document and printing it takes some of the anxiety out of the writing process itself. This separation of typing from printing, of electronic document from printed copy, makes all the difference in the world. It lets you erase, amend and rearrange your document without retyping any of the existing text. When you type something on a typewriter, the characters are immediately recorded on paper. If you change your mind or notice mistake, you need to erase characters or retype a page or more of text.

8.1 WHAT CAN WORD PROCESSORS DO?

Erasing and Inserting Characters

If you erase characters, the program automatically closes any gaps left behind. If you insert characters, it pushes existing characters to the right or down to make room for the new text (Fig.8.1).

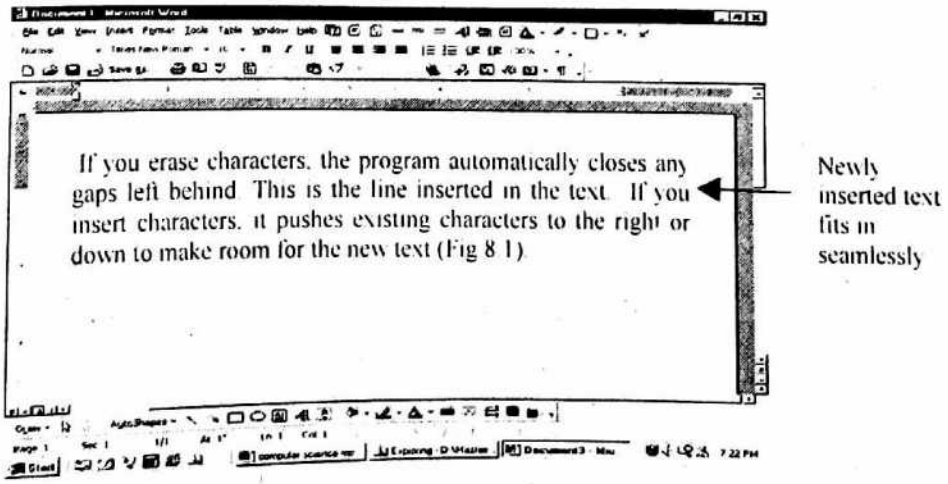

Fig.8.1. Inserting text in a document.

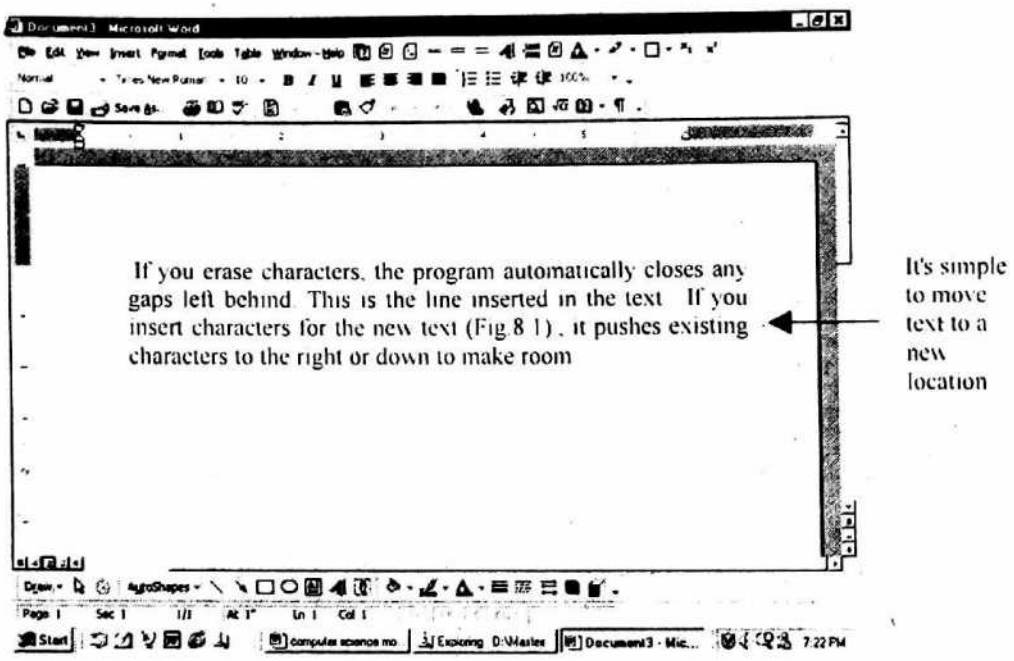

Fig.8.2. Moving text to a new location.

Moving Text

If you decide that a particular sentence or paragraph really belongs somewhere else in your document, you simply move it to the desired spot and let your program rearrange the rest of document to accommodate the change (Fig.8.2).

Undoing and Redoing Actions

Most word processing programs even let you change your mind about such editorial changes, providing you with an undo or an undelete command that reverses the effects of the last deletion, move or other action. In fact, now you can usually reverse many actions and if you change your mind about something you undid, you can just as easily "redo" it.

Printing Your Document

When you are ready to print your document, you simply issue a print command. In almost all Windows programs, this involves opening the File menu, selecting Print and clicking OK in the dialog box that appears. In many Windows programs you can also click a Print icon (with a picture of a printer) near the top of the screen to print a single copy of your document without going through the dialog box.

Searching for and Replacing Characters

Word processors can search for and replace a specified set of characters. This feature is useful if you find that you have misspelled someone's name throughout a document. You can also use it to save yourself typing. You can, for example, type some obscure character like the ~ every time you want to display your company's name and then later replace every occurrence of ~ with the name itself.

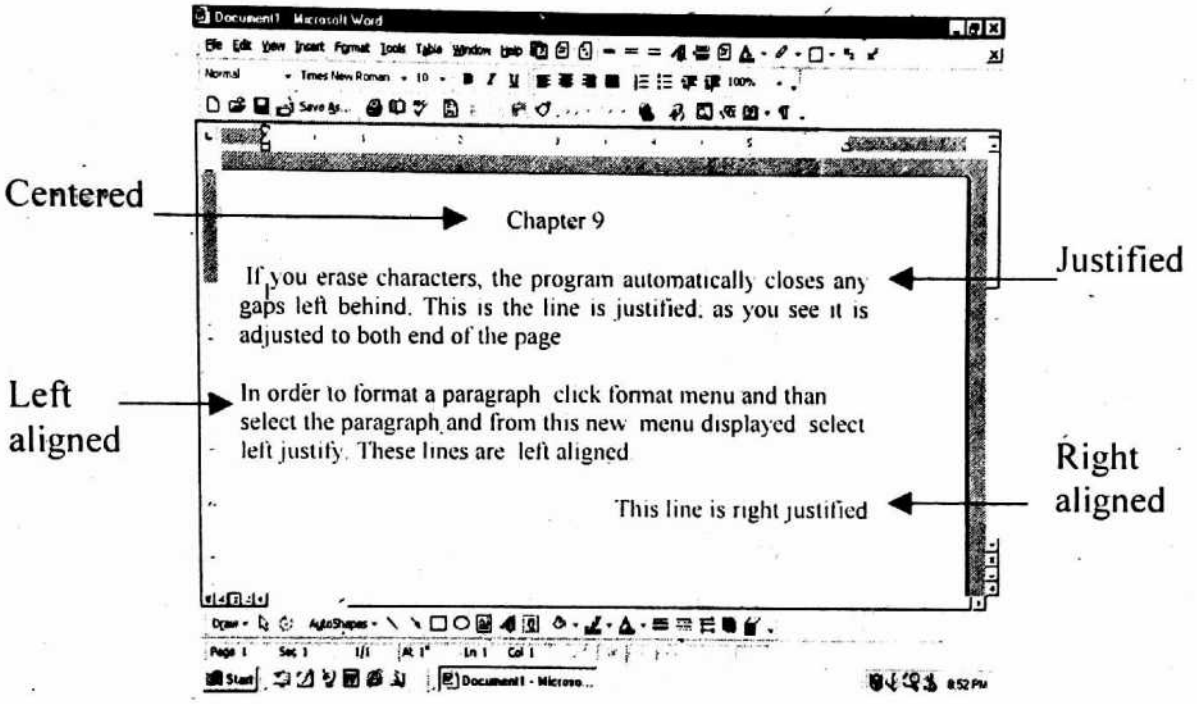

Fig.8.3. Aligning text.

Aligning Text

Word processors can also automatically center text, align it with the right margin or full-justify text, so that characters line up at the right as well as the left margin (Fig.8.3).

Numbering Pages

You can have a word processor automatically print page numbers at either the top or bottom of each page. This saves you the trouble of entering page numbers within the text and then moving them around when your editing causes the page breaks to move slightly.

Adding Headers and Footers

You can print headers and footers which is specified sets of text at the top or bottom of each page. These headers and footers can include the current page number. Some programs let you specify different headers or footers for the first page of your document or for odd or even pages. You won't always see page numbers or headers and footers in the on screen version of your document. However, they should show up when you do a print preview or print the document.

Using Footnotes and Endnotes

Another thing you may want to do is to format and manage footnotes and endnotes. Most word processing programs let you attach footnotes or endnotes to particular spots in your document. If you add more footnotes or rearrange text, the program automatically moves and renumbers the notes as necessary. If you use footnotes rather than endnotes, the program automatically figures out how much room is required for notes at the bottom of each page and print the footnotes exactly where they belong.

Columns

You can arrange text in two or more columns as many leaflets and most periodicals do.

Spell Checking

You can have your word processor check your document for misspelled words, a process known as spell checking. Spell checkers can prove invaluable. They are, however, no substitute for human proofreading. Spell checkers only check whether a particular word exists, they don't tell you if it is the right word for a particular context. If you type "here" when you mean "hear," for example, the spell checker will not blink.

Using the Built-in Thesaurus

You can locate synonyms for a selected word. This thesaurus feature can prove invaluable if you find yourself using the same word over and over or when you cannot pinpoint the word you want.

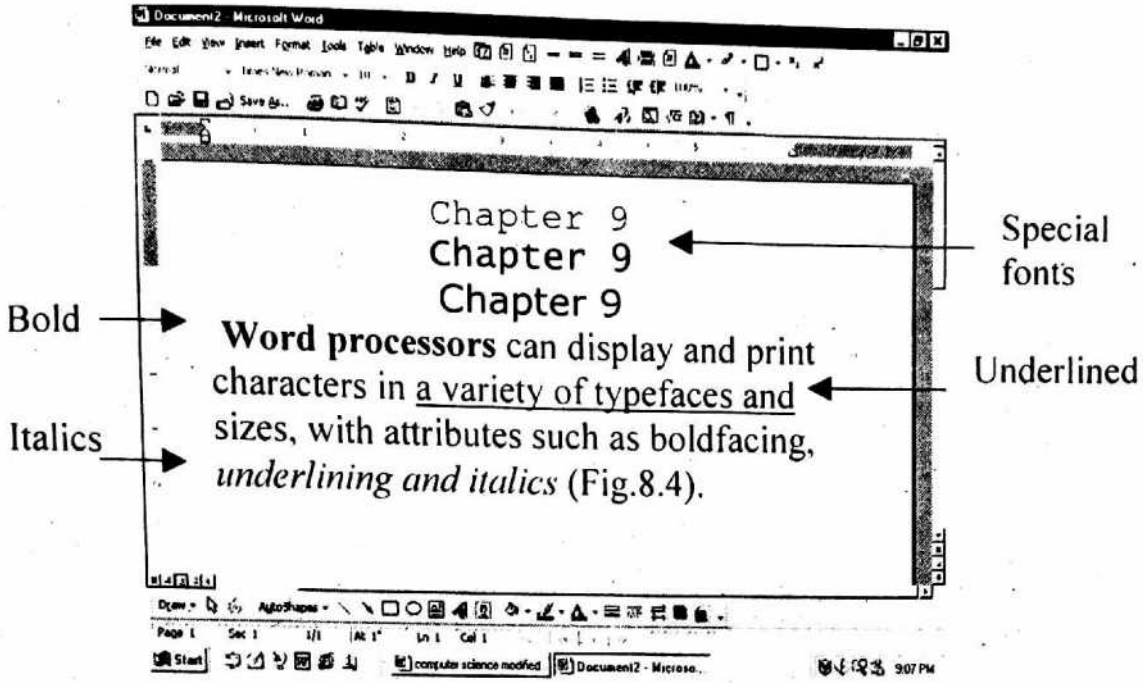

Fig.8.4. Different typefaces and text styles.

Using Different Typefaces and Text Styles

Word processors can display and print characters in a variety of typefaces and sizes, with attributes such as boldfacing, underlining and italics (Fig.8.4).

Inserting Special Characters

Most word processors let you enter special characters that you cannot generate on most typewriters, including foreign language characters, bullets and mathematical symbols.

Creating Personalized Output

This feature, commonly known as mail merge, lets you generate documents, each of which includes, for example, a different individual's name and address.

Formatting

Almost all word processing software's have the formatting capabilities. Formatting is generally listed in the menu. Formatting includes, aligning the text, defining the font type, defining the typefaces (bold, italics etc.), defining the line spacing, selecting the style already defined in the word processor or

user-defined style, depending on the type of the word processor being used the capability of formatting is different.

Adding Graphics

You can incorporate lines, boxes and pictures within a document. This capability is particularly useful for producing newsletters or fancy reports.

Editing formulas

Most of the word processing done for scientific purposes requires typing various formulas or equations. Formula editing is generally done, by using the insertion capability of the word processor. In this case a menu is displayed and from this menu the required option, such as, the brackets, integral sign, ratios or various symbols can be selected and placed in the appropriate location.

Including charts and graphs

Charts and graphs are added to the text using the insertion capability of the word processor. When the chart or graph insertion is selected a new menu is displayed and the type of the graph is selected. The various types used are, bar graph, pie chart, line graph, etc. Once the type has been selected the user has to enter the data required to create the graph.

Using Tables and Grids

Many word processing programs have tools for creating and managing tables of information, that is, text entered in grid of rows and columns. Most programs allow you to adjust the width of columns after you enter your text and some let you apply special formatting, such as, shading every other row.

Checking Your Grammar

Some programs let you scan your document for grammatical problems, such as incorrect punctuation and double negatives and for stylistic problems, such as overuse of the passive voice or use of redundant expressions.

8.2 USING A WORD PROCESSING PROGRAM

This section explains what a word processing program look like and how to use it for creating documents. It also describes the important concepts involved in word processing.

A Tour of the Screen

When you first start up a word processing program, your screen is largely blank. As soon as you start typing, this page starts filling with characters. Most word processing screens also contain a menu at the top of the screen and in some cases one or more sets of icons, generally called toolbars, representing additional choices. You will have to refer to your software manual for information on what each of the menu options and icons do. There will also most likely be a status bar at the bottom of the screen telling you such things as how many pages your document contains and which page you are on.

The Insertion Point

Every word processing screen also contains a symbol that serves as a "you are here" marker. When you start the program, this symbol appears in the upper-left corner of the typing area. If you are entering text, this symbol indicates where the next character will appear. If you are deleting text, it tells you which character you are about to erase. If you are using a Windows-based word processing program, you will see a blinking vertical line, the insertion point. In many DOS-based programs, this character looked quite different and was called the cursor.

The insertion point is not the same as the mouse pointer. To move the insertion point, move the mouse pointer to the desired spot and click or use the cursor-movement keys. If you have trouble distinguishing the pointer from the insertion point, remember that the insertion point blinks and the pointer moves when you move the mouse.

Scrolling Your Document

One of the first things to understand about word processing programs is that as soon as you fill up the screen with text, the program starts scrolling lines off the top to make room for additional characters. To get used to this, think of your document as one long scroll or piece of paper. As you move up or down within it, part of your document may disappear from the screen but it is not

erased from memory. You can always scroll up or down to bring it back into view.

Word Wrap

A central feature of all word processors is a feature known as word wrap. Word wrap means that as you type, the program "wraps" the text to the next line when you reach the right margin. There is no need to press the Enter key. In a sense, the computer handles your entire document as one long ribbon of characters that wraps from one line to the next. If you erase some characters, the program pulls the rest of the ribbon leftward or up a line to close the gap. If you add characters in the middle, the rest of the ribbon is pushed forward and/or down.

How Hard Returns Work?

If you learned to type on a typewriter, you will have to train yourself not to press the Enter key, when you get near the right margin. Not only is pressing Enter unnecessary, it can actually create problems. When you press Enter, the program inserts what is known as a hard return, a code that tells the program, "Go to the next line, no matter where you are in relation to the margins." Whenever the program encounters a hard return, it breaks the line at that spot, regardless of how few words are on the line. If you press Enter at the end of a line and later delete characters from that line, the line break will not change accordingly.

8.3 SUMMARY

FEATURES OF WORD PROCESSING SOFTWARE

Word processing is similar to typing a document on a typewriter but there are some differences. Word processors provide many features which are not available in a typewriter. Some of the important features offered by word processing software are listed below.

1) You can easily insert and erase characters in your document.
2) A sentence or paragraph can be moved to some other location in the document and the program automatically rearranges the document to accommodate the change.

3) Undo command can reverse the effect of the last deletion, move or other action and if you change your mind about something you undid, you can easily "redo" it using the Redo command.
4) You can easily print a single copy of your document by clicking the Print icon with a picture of printer near the top of the screen. You can also open the File menu, select Print and click OK after making various settings in the Print dialog box.
5) Word processors provide the facilities to search and replace characters throughout the document.
6) Word processors can automatically align the text on the page according to your requirements.
7) You can automatically number the pages at either the top or the bottom of each page.
8) You can print specified sets of text at the top or bottom of each page known as headers or footers.
9) Word processing programs let you attach footnotes or endnotes to particular spots in your document.
10) You can arrange text in two or more columns.
11) Spell checkers provided in word processing software can check your document for misspelled words. Thesaurus feature can help you find synonyms for selected words.
12) A variety of typefaces and text styles can be used in documents.
13) Word processors allow you to enter special characters that you cannot find on most typewriters.
14) The mail merge feature allows to generate documents each of which includes for example, a different individual's name and address.
15) Formatting capabilities of word processing software lets you define the font type, define the typeface, define the spacing, set the margins, etc.
16) You can add lines, boxes and pictures within a document for producing fancy output.
17) Formulas or equations including various mathematical symbols such as the brackets, integral sign, ratio or various symbols can be placed in documents.
18) You can incorporate charts and graphs to the text.
19) Word processors have tools for creating and managing tables of information.
20) You can check the grammar of your document.

USING A WORD PROCESSING PROGRAM

When you start up a word processing program, you see a menu at the top of the screen and one or more sets of icons, known as tool bar, representing additional choices. At the bottom of the screen there is a status bar telling you such things as the total number of pages in the document and the page you are on.

All the word processing programs contain a blinking vertical line called insertion point and it indicates where the next character will appear. If you are deleting text, it will tell you which character you are about to erase.

When you fill up the screen with text, the program starts scrolling lines off the top to make room for additional characters. Another important feature of a word processing program is that when you reach the right margin, you don't have to press the Enter key. The program will automatically wrap the text to the next line. When you press the Enter key, it inserts a hard return, a code that tells the program to go to the next line, no matter where you are in that line.

8.4 EXERCISE

1. Fill in the blanks.
   i) ..... is a specified text at the top of each page.
   ii) The ..... feature of a word processor is used to find synonyms for a selected word.
   iii) When you press Enter, the word processor inserts a code that is known as .....
   iv) ..... means that as you type, the word processor wraps the text to the next line when you reach the right margin.
   v) Most word processors let you enter ..... characters that you cannot type on most typewriters.
   vi) The ..... feature lets you generate documents each of which includes, for example, a different individual's name and address.
   vii) ..... a document means, aligning the text, defining the line spacing, defining the typefaces, defining the font type, etc.
   viii) While typing in a document in a word processing program, you will see a blinking vertical line as the ..... which indicates where the next character will appear.
2. What is word processing?

3. Compare preparing a document using a word processing program on a computer to typing it on a typewriter.

4. Explain the important features of a word processor.

5. Explain the following terms.

   i) Word Wrap ii) Thesaurus
   iii) Headers and Footers iv) Mail merge

6. Explain the type of problems a new user can face while using a word processing program on a computer instead of using a typewriter.

CHAPTER 9

SPREADSHEET PROGRAMS

9.1 INTRODUCTION TO SPREADSHEET

A spreadsheet is a grid of rows and columns in which you enter numbers and text. Spreadsheet programs are the number crunchers of the computer world, although they can manipulate text as well. Think of them as powerful, multipurpose calculators, capable of everything from adding two plus two to solving problems that involve complicated calculations.

The Work Area Is a Grid

Although the appearance of spreadsheet programs varies a bit from one program to the next, they all have features in common. Usually, the screen is largely occupied by a grid of rows and columns, frequently known as the work area or worksheet area (Fig.9.1).

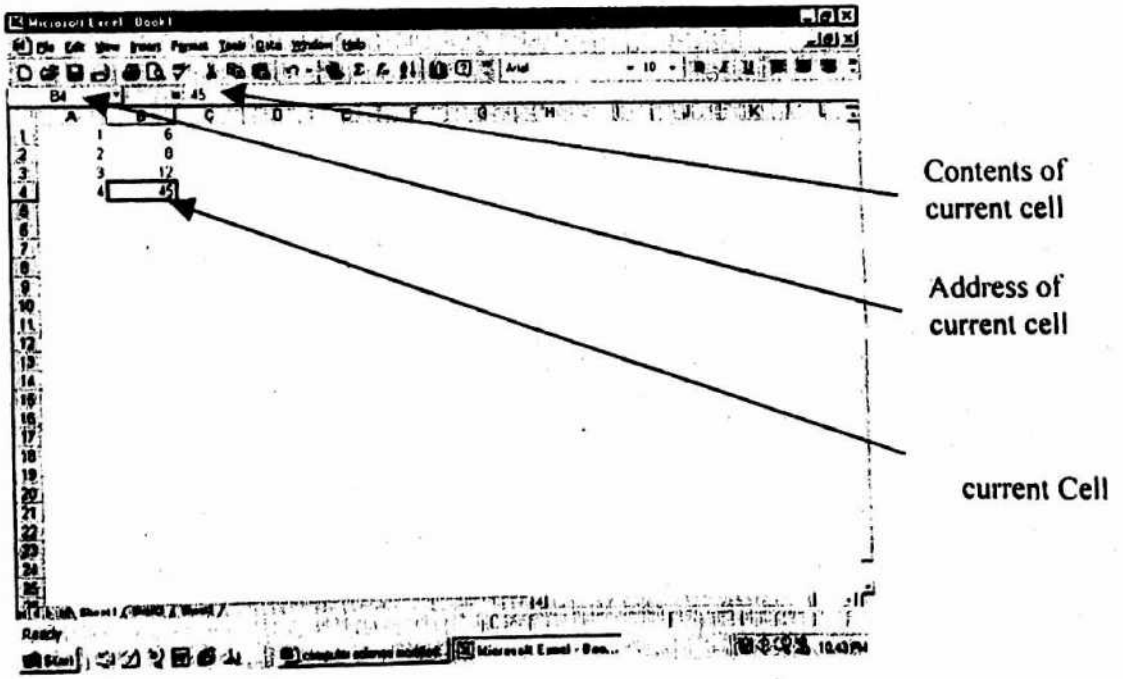

Fig.9.1. Worksheet area.

How Cells Are Identified?

The columns within the work area are identified by letters shown at the top of the work area. The rows are identified by numbers shown at the left side of the work area (Fig.9.1). The boxes formed by the intersection of individual rows and columns are known as cells. Cells are identified by the combination of their column letter and row number. The fifth cell in the second column is known as cell B5, for example. The letter always comes first. This is known as cell's address or cell coordinates.

The Active Cell

At any given moment, you are positioned in a single cell, generally known as the current cell or active cell. When you enter data, it goes in this cell and when you apply formatting such as boldfacing, it is applied to this current cell.

How to Tell Which Cell You Are In?

You can always tell which cell you are in by looking at the position of the cell pointer which is a highlight or dark border you can move from one cell to the next using the cursor movement keys or your mouse. The address of the current cell is typically displayed on a line just above the work area, in an area usually known as the cell address indicator. To the right of the cell address indicator, in an area sometimes called the formula bar, you will probably see the contents of the current cell which can be numbers, text or formula.

How Big Is Your Spreadsheet?

When you create a new spreadsheet, the grid of rows and columns is empty. You start with the equivalent of a blank sheet of ledger paper. The size of this "piece of paper" is actually huge. Most spreadsheets contain hundreds of columns and several thousand rows (millions of cells). What appears on the screen, however, is a small portion of that "page", usually about a dozen columns and a couple of dozen rows. To find your way around the spreadsheet, imagine the work area as a movable window, just as you do in a word processing program. You can move the window sideways to view additional columns as well as up and down to view additional rows.

The Spreadsheet Screen

Most spreadsheets contain a menu bar at the top of the screen. This menu bar is typically visible all the time. The menus vary from program to program but in general, you use menu commands to do things like moving, copying and erasing blocks of data, inserting or deleting columns and rows, printing, saving and changing the appearance of data. Many spreadsheets also include one or more toolbars (also called button bar or speed bar). These toolbars provide you with quick (single-click) access to common commands, such as Print, Cut and Copy.

9.2 HOW SPREADSHEETS WORK

Although spreadsheets are capable of calculating almost anything you can imagine, they are not set up in advance to perform any particular calculations. It is your job to fill in the grid by entering text, numbers and instructions (formulas) that direct the computer to perform particular calculations.

Using Formulas to Perform Calculations

Suppose you want to calculate the net income for a company. You might start by entering the numbers for total revenue in one cell and for total expenses in another. You may also enter text identifying these numbers in two adjacent cells. Then you would enter a formula telling the program to subtract the expenses from the revenue and display the result. You do this by moving to a blank cell and typing in an instruction describing the desired calculation.

For example, if cell B3 contains the figure for revenue and cell B4 contains your expenses, you would enter a formula such as +B3-B4 or (B3-B4) or =B3-B4. The exact syntax for formulas varies among spreadsheet programs. Think of this formula as "take whatever value currently appears in cell B3, subtract the value that currently appears in cell B4 and then display the result in this cell."

Formula Results Are Recalculated Automatically

Whenever you change the value in cell B3 or B4, the result of the formula will be automatically updated. This feature, known as automatic recalculation, is one of the main advantages that spreadsheets offer over calculators. After you tell the spreadsheet what to do, you are free to change the raw data as much

and as often as you like and the program does the work of recalculating the results.

Automatic recalculation lets you change a few of your numbers and have the program update the results of any calculations. You don't have to reiterate your instructions or reenter any data that did not change.

When Formula Results Change, Other Formulas Based on Them Are Recalculated

The advantages grow even more obvious when you have more formulas and some of them rely on the results of others. Every time you change the value in a cell the results of any formula that refers to that cell, are updated. Any other cells that refer to those results are updated as well. In this way, a single change in the value may set off a chain reaction, instigating changes in several cells throughout the spreadsheet.

Functions

Besides automatic recalculation, functions are another big advantage spreadsheet offers over calculators. All spreadsheet programs feature functions which are built-in tools for performing calculations other than simple calculations (addition, subtraction, multiplication and division). Most major spreadsheet programs offer around 100 different functions. You can calculate averages, square roots, depreciation, payments or earnings on annuities and standard deviation to name just a few.

Database Management Capabilities

Most spreadsheet programs offer at least a few database management capabilities, that is, tools for managing lists. At a minimum, they allow you to sort a set of rows alphabetically or numerically and to select items that match specified selection criteria. Bear in mind that if your list exceeds a hundred items or if you need to produce formatted reports or mailing labels, you are better off using a database management program.

Desktop Publishing Tools

Many spreadsheet programs offer desktop publishing tools, enabling you to mix and match fonts within a spreadsheet, print spreadsheets sideways and

dress them up with lines, boxes, shading and graphical elements such as pictures and logos.

Linking Files and Three-Dimensional Spreadsheets

Many spreadsheet programs offer tools for linking multiple spreadsheet files so that a formula in one file can refer to cells in another file. Others let you store multiple sets of information within a single file. This is called a three-dimensional spreadsheet, spreadsheet notebook or workbook. Such features can prove extremely useful for consolidating information from several departments or time periods, or organizing several distinct but related sets of information.

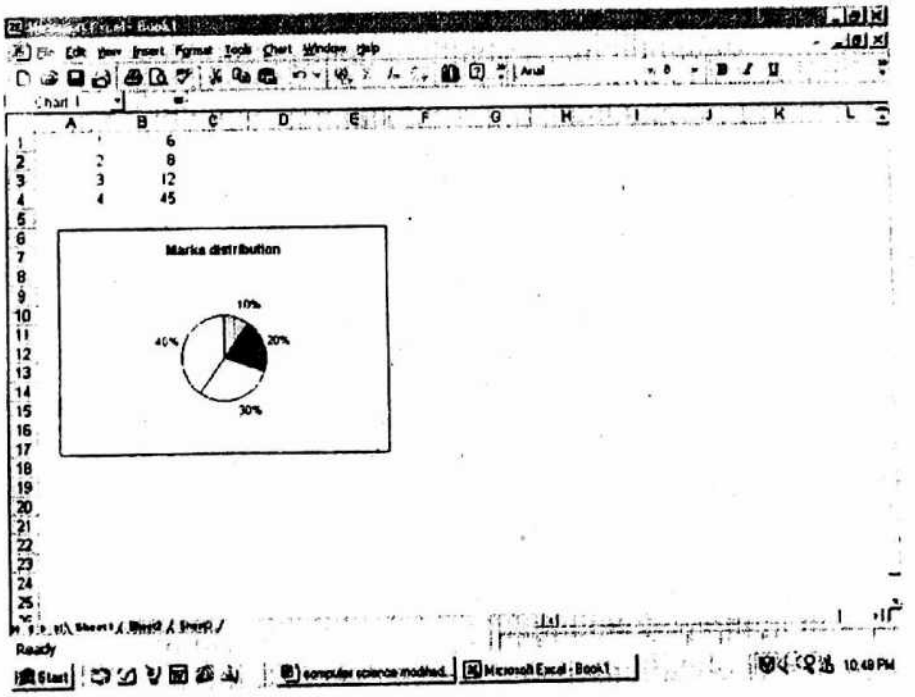

Fig.9.2. Graph in a worksheet.

Graphs and Design Elements

Most spreadsheet programs offer some means of representing the numbers within your spreadsheet in graphical form, as a bar chart, line chart, or pie chart among others. Some offer sophisticated graphing features that let you create dozens of different types of graphs and dress up your graphs with lines, boxes, text and other design elements.

9.3 SUMMARY

Spreadsheet programs are used to store and manipulate numeric data in tabular form. They have a huge grid of rows and columns where you enter numbers and text.

The columns within the work area are identified by letters shown at the top and the rows are identified by numbers shown at the left side of the work area. For example, the third cell in the second column is identified as B3 and this is known as the address of that cell.

The current or active cell where the data will go is a highlight or dark border. The address of current cell is displayed on a line just above the work area. You can use the mouse or arrow keys to move the cursor from one cell to another.

Most spreadsheets contain hundreds of columns and several thousand rows. You see a portion of that page and it appears as a movable window. Just like a word processing program, a spreadsheet program also contains a menu and a tool bar at the top and a status bar at the bottom of the screen for making various choices. These include copying, moving and erasing blocks of text, changing the appearance of data and saving and printing the worksheet.

A large variety of calculations can be performed using a spreadsheet program. A spreadsheet is not set up in advance to perform any particular calculations, it is the job of the user to fill in the grid by entering text, numbers and formulas.

A remarkable feature of a spreadsheet program is that if you change the value used in a formula the result will be automatically updated. When formula results change, other formulas based on them are also recalculated. Many commonly used functions such as average, standard deviation, square root and depreciation are provided in the program which are built-in tools for performing calculations other than simple calculations.

Spreadsheet programs have the basic database management capabilities for managing lists of records.

A three-dimensional spreadsheet known as workbook, allows to store multiple sets of information within a single sheet.

A large variety of charts and graphs can be incorporated in the worksheet to produce better reports.

9.4 EXERCISE

1. Fill in the blanks.
   i) A ..... is a grid of rows and columns in which you can enter numbers and text.
   ii) In a worksheet, a ..... is identified by the combination of column letter and row number.
   iii) Most spreadsheets contain hundreds of .....and thousands of .....
   iv) Whenever you change the value in a cell, the results of any formulas that refer to that cell, are ..... recalculated.
   v) Most spreadsheet programs offer at least a few ..... capabilities for managing lists.
   vi) Spreadsheet programs offer tools for..... multiple spreadsheet files so that a formula in one file can refer to cells in another file.
   vii) Spreadsheet programs offer built-in ..... which let you perform calculations other than simple calculations.
   viii) While using a worksheet program, at any moment, you are positioned in a single cell, known as ..... cell.

2. Define spreadsheet and a spreadsheet program.

3. What are the important features of a spreadsheet program?

4. Mention some application areas where spreadsheet can be useful.

5. Create a spreadsheet of your timetable in Excel and print it. The timetable should include, six days of the week and timing of the classes along with the break

6. Create a spreadsheet of examination results of 5 students and 6 subjects. Calculate their total and average marks and arrange the list in descending order by total marks.

CHAPTER 10

INTERNET BROWSING AND E-MAIL

10.1 INTRODUCTION TO INTERNET

The global phenomenon of the Internet has changed the way businesses and individuals access and use information. As both a powerful communication tool and a comprehensive data repository, the Internet has quickly become a necessity in today's business environment. Therefore, it is important to understand what the Internet offers and how you can connect individual Windows computers or your entire network to it.

The Internet's roots can be traced back to the late 1960s, when the Advanced Research Projects Agency or ARPA, under the US Department of Defense designed a network to safeguard military information stored on computers all over the country. Originally called ARPANET, this network connected strategically located computers so that if one link were destroyed by an attack or natural disaster, surviving computers could continue to communicate with each other.

In 1985, the National Science Foundation (NSF) funded several national supercomputer centers and enabled regional and university computer centers to connect to them. The initial motivation to connect these was the availability of remote access to these supercomputer resources. This event marked the birth of the Internet as we know it today.

By 1994, the NSF announced the establishment of four Network Access Points (NAPs), which would offer high-speed connections between networks on regional scale. Operated by the private sector, these NAPs were created in San Francisco, Chicago, New Jersey and Washington, DC.

Over the years, many universities, research facilities and private companies all over the world have hooked up to this network to exchange information. More recently, millions of organizations and individuals have connected to the Internet to access, publish and discuss vast amounts of information on just about every topic. Internet is a revolution in communications. The concept of having instant access to a global information resource at home, at school and

at work has already changed the way we work with and think about information.

It is difficult to judge the size of the Internet. people and systems are being added daily. New user sites are continuously being added. In fact, the Internet has grown at an exponential rate since its beginning. It is the largest network of computers in the world and is growing at about ten percent each month.

The top layer of the Internet is made up of a handful of NAPs. However, most organizations don't deal directly with a NAP. The Internet has been further subdivided hierarchically into several layers to maintain performance, simplify management and achieve robustness of the network. The layer of the Internet that businesses and consumers deal with directly is populated by Internet Service Providers, or ISP. For a fee, they provide organizations and individuals with dial-up or dedicated connections to the Internet.

NAPs and ISPs connect to each other using high-speed communication lines. The set of these fast links is called the Internet's Backbone. Backbone is actually a more generic term, referring to any high-speed link between networks. Other lower-speed networks connect to the network, much like ribs connect to a person's backbone.

The Potential of the Internet in Education

The only things that are needed to connect to the Internet are a computer, a modem, a telephone line, an Internet provider and Internet software. Assuming that an educator or student has access to all these and the time and knowledge to use the Internet, how can it be used as an educational tool? Below are just some of the many useful tools available to the Internet user and how they might be helpful to an educator or student.

E-mail

Perhaps the first step that many people have tried when using the Internet is e-mail. In theory, e-mail is an instantaneous electronic message from a sender to a recipient or multiple recipients. Compared to postal mail, e-mail is probably the most used application in the Internet. With e-mail, the educator can let students set up "Internet friends" with other children in nearby classrooms, in other cities, in other countries or even in other continents. This promotes computer usage and allows students to improve their language skills such as their reading, writing, thinking and listening abilities.

Through e-mail, students can send messages to literally thousands of businesses or to private individuals. Children can ask experts in a certain field such as politics or science, a list of questions to be answered. Teachers can use the e-mail in the same way, by talking to colleagues thousands of miles away, comparing lesson plans, etc.

To use e-mail, the sender simply opens the e-mail program and types in an address, a subject, and the message in the body of the letter. Once the letter is ready to be sent, the user simply clicks a send command and the letter is instantly transmitted to its destination.

World Wide Web (WWW)

The World Wide Web (WWW) makes up a very large percentage of the Internet. Nearly seventy percent of all information searches are handled through the World Wide Web. This is where most educators and students find their information on nearly any subject. Information is quickly found in the World Wide Web through typing key words or file names if known. The keywords are searched through different search engines such as Infoseek, Lycos or through search directories such as Yahoo. These search engines look for key words in their files. The search results from the search engine are then listed and the educator or student can choose from the titles found. The World Wide Web has thousand of interesting sites. The information to learn just about anything is probably contained somewhere in the web. It is just up to the user to find it and learn from it.

HTML is the major language of the Internet's World Wide Web. It stands for Hyper Text Markup Language. Web sites and web pages are written in HTML. With HTML and the World Wide Web, you have the ability to bring together text, pictures, sounds, video clips and links all in one place. HTML files are plain text files, so they can be composed and edited on any type of computer.

Getting Started

Getting connected to the Internet is fairly simple but there are a number of steps you need to take before hand.

The first requirement will be to locate an Internet Service Provider (ISP) in your area. This is a company through which you can access the Internet. Prices and features will vary, so calling around and shopping for the best price is

recommended. Typically, your local ISP will offer you a monthly package which will include e-mail, web access, download/upload capabilities and newsgroups.

Once you have found an ISP and signed their service agreement, next you will need to install some software on your computer. In many cases your ISP will help you with that installation. Below is a list of the software that your ISP will install.

Telecommunication Software
A World Wide Web Browser
An E-mail Program

With all this software installed, you will be ready to access the Internet. Once you are ready, it is now time to connect to the Internet. Your computer will dial a local number, which is provided by your ISP. Once you have logged into your ISP, you are connected to the Internet.

Disadvantages of Internet

A major concern from educators and parents is that the child may access indecent or restricted sites on the Internet such as pornography or adult natured material. Many schools have installed blocking systems which block or require passwords to access the restricted sites. In actuality, it is nearly impossible to ensure that children will not access these areas, since some children may already have much experience with using the Internet. The teachers can closely monitor computer screens to ensure that children are not visiting indecent sites.

A problem also exists on the Internet when searching for information. The Internet searches for information by typing key words into a search engine such as Infoseek, Excite, Lycos, etc. or into directories such as Yahoo. Each search engine contains its own subjects and ways of organizing information. Often an educator or student may only employ one search engine such as Lycos, to obtain information when the other search engine might contain better sites.

Another problem exists in the Internet because you can get distracted from your topic while finding a more interesting web site. This can be turned into a learning tool by occasionally allowing the students to actively seek out topics they may find more interesting than the one in which they originally were

looking for. Learning often takes place when students are internally motivated about subjects and occasionally flexibility on the teacher's part can increase the child's interest and self motivation to want to use the Internet.

Though the Internet is new in the school setting, it will soon be common place if current growth continues. The educator can prepare for the future now by learning and experimenting with the Internet. The possibilities are endless and it is truly up to the teacher or student to develop creative ways of using it in the classroom. The Internet can creatively motivate and inspire students to learn more about their world. The Internet brings the future closer and we must begin to use and expand its potential when ever possible.

10.2 INTERNET ADDRESSES

There are six primary domains for U.S. Internet sites: com (commercial), edu (educational), gov (government), mil (military), net (network) and org (organization). Any address that does not end with one of these six domain names is probably located outside the United States. For example, the domain name **pk** stands for Pakistan, **fr** for France and **ae** for United Arab Emirates.

A Sample Internet Address

To give an example, the address smith@spark.berkeley.edu refers to a person with a username of Smith who logs into a host computer named spark, which is part of a domain named berkeley (for the University of California at Berkeley), which in turn, is part of the primary domain named edu (for education).

E-mail Addresses Versus URLs

Internet e-mail addresses are different from URLs (Uniform Resource Locators). E-mail addresses are used to identify a particular user on the Internet and URLs are used to identify a Web server, that is, a computer that makes information available via the World Wide Web. The URL is what you type into your Web browser program to tell it to go to and display a particular page of information.

10.3 BROWSING THE WEB

Making a leap from one computer's Web page to another's is simple matter of clicking a picture or piece of text, known as a link, on the screen. Such links allow users to interact with documents stored on computers across the Internet as though they were part of a single text. Using links to jump from site to site is commonly known as surfing the Web. One of the main reasons for the Web's success is its graphical interface which presents colorful typeset pages, graphics, sounds and videos.

Programs designed to let you access and navigate the Web are known as Web browsers. These days, most browsers are more properly called Internet browsers because they include e-mail capabilities, newsreaders and tools for downloading files. The most widely used browsers are Netscape Communicator and Internet Explorer.

When you first run your browser, you will probably land on a particular Web page. Which one will depend on which browser you are using. All the major browsers offer some means of storing the names and URLs of sites that you like so you can easily return to them later. In Netscape Communicator, these stored site addresses are called bookmarks. In Internet Explorer, they are called favorites.

Getting to a Web Page

There are two main ways to get to a page on the Web. You can enter the URL for the page and press Enter or you can click a link (text or graphical) that leads to the desired page.

Both Netscape Communicator and Internet Explorer feature a combo box/drop-down list labeled Address or Location near the top of the browser window. You type the URL there and press Enter. If the URL for the page you want to access begins with the characters, http://www, you can omit that part and just enter the rest of the URL. If the URL ends with .com, you can even omit that part too. If you click the arrow at the right of the address/location box, you will see a list of the URLs you accessed most recently. Select from the list if you want to return to one of those sites.

While the browser is fetching the page, you will probably see a status message at the bottom of the browser's window, indicating how much of the transfer is

already complete. You don't have to wait until a page has finished displaying before you scroll through the text or move on to another page.

Clicking Links

If the page you are viewing contains a link that interests you, just click the link to move directly to a page on the specified topic. If you want to return to the previous page, just click the Back button on your browser. After you have used a particular link on a page, the link changes color. This lets you see which links you have already traveled.

The Home Button

Both Netscape Communicator and Internet Explorer have buttons near the top of their windows that let you accomplish common operations. Home takes you back to the start page, that is, the page that was displayed when you first ran the browser.

The Back and Forward Buttons

Back redisplays the last page you viewed. You can keep reversing your steps by continuing to click Back. The Forward button undoes the effect of the Back button, taking you back to the page you were on when you clicked Back.

The Stop Button

The Stop button aborts the current transfer of information from the ISP (Internet Service Provider) to your computer. You will find this useful if your browser is in the midst of displaying a page and you decide it's not worth the wait or decide to cancel a download in the middle of the process.

The Print Button

The Print button sends an image of the currently displayed page to your printer.

Creating a Bookmark or Favorite

To create a bookmark or favorite, first get to the page you want your browser to remember. Then, if you have Netscape, click the Bookmarks button and

choose Add Bookmark. If you are using the Internet Explorer, click the Favorite option on the menu and select Add to Favorites.

Finding a Marked Page

You can quickly go to a book marked or favorite page after you have marked it as such. To do this in Explorer, pull down the Favorites menu and choose the site from there. You may need to choose the category you want from the Favorites menu and choose your favorite site from the submenu that appears. In Netscape, just click the Bookmarks button and choose the desired bookmark or bookmark category, from the menu that appears.

10.4 SEARCHING FOR SITES

There are millions of sites on the Web and more are created every minute. One of the great challenges of using the Web is finding sites that interest you or that contain information you are looking for.

Major browsers provide links directly to recommended new and interesting sites. Netscape features buttons for this.

Dozens of search engines are designed to help you search for resources on the Web. Some of the most popular are AltaVista, Excite, Lycos and Yahoo!. These let you hunt for Web pages by entering one or more keywords . Many also feature directories of Web sites so that you can search for information by category.

Entering Keywords

To search by keyword after you are at a search site, just type the word and click the adjacent button labeled Search, Seek, Go Get It or the equivalent. The procedure for searching for more than one word varies from service to service. In some cases, you just type in the words. In others, you place a plus sign before each keyword that has to appear in the search result. In some cases, if you want to search for a particular phrase, you enclose the phrase in quotes.

How Results Are Displayed

Most search services display results a few sites at a time. You will see the total number of matches found and then the first ten sites, often the ones that are most relevant or that most closely match your criteria. The information shown for each site usually includes a title which is also a link to the site and a brief description. To display the next set of sites, click a button labeled Next Results, Next Page or the equivalent at the bottom of the page.

10.5 DOWNLOADING AND INSTALLING SOFTWARE

The Internet is also becoming a popular means of distributing upgrades to commercial software because it saves the software manufacturer the cost of creating, packing and shipping disks. It is a good idea to check software vendors' Web sites for news of upgrades to your favorite programs including your browser. Minor upgrades are often free, major upgrades usually come at a price.

How to Download

When you reach a Web site that offers software downloads, the first thing you should do is read the installation instructions at the site itself. Then click the link often labeled Download that initiates the download process. In most cases, you will see a Save As dialog box. Usually, you will see a suggested filename in the Save As dialog box, just choose OK to accept that default.

Compressed Files

Many of the files you download from the Internet will be compressed. File compression means translation of file into a coded format that occupies less space than the original file.

There are reasons people compress files:

1) To save room on disk.
2) To save time when sending data from one computer to another. You cannot actually use files in their compressed form. Rather, you need to decompress (expand) them to their original size.

Some of the files yo download will decompress and install themselves automatically while you are still online. Others will be what are known as self-extracting EXE files, meaning when you execute (run) them they automatically decompress. Many compressed files actually contain compressed versions of multiple files. When you decompress them, you may therefore get several decompressed files, not just one. After you have run a self-extracting EXE file, you need to look for a file named SETUP or INSTALL and run that one to finish the installation process.

Some of the files you download on the Internet are zip files, meaning that they employ the commonly used PKZIP format and they have an extension of ZIP. You will need a special program to "unzip" such files. The most popular one for Windows is a program named WinZip.

10.6 SENDING AND READING E-MAIL

E-mail is the best thing the Internet has to offer. E-mail is a communication tool. If you spend a lot of time at your computer, you can easily send your messages without leaving your desk. You can cut and paste text from documents already on your computer. You can also attach files to your message.

E-mail Programs

Many mail programs are available. For example, when you install Office97, you get a program named Microsoft Outlook which is both a mail program and a general information manager. It includes a calendar, a contact manager and other utilities. Internet Explorer version 4.0 and Windows 98 come with a mail program called Outlook Express. In addition, Netscape and many other browsers come with their own e-mail utilities that are built into the browser. Finally, there are specialized mail programs (Eudora is the most popular) that do nothing but send, receive and help you manage your e-mail. The advantage of these is that they make it easy to sort messages and address mail to lists of people.

Creating E-mail Messages

How you create a message depends on which program you are using. In Netscape, the simplest method is to pull down the File menu, choose New and then choose Message to open a Composition window. You can also run your

mail program (Microsoft Exchange, Outlook Express, whatever) and then either click the Compose Message button or New Mail Message button or look for a Compose option on the menu bar.

Regardless of which mail program you are using, after you initiate the process of composing a message, you arrive at a message composition window. In this window, you specify an e-mail address to send the message to, a subject and type the message.

Sending Messages

In Netscape, when you click the Send button, your message is delivered immediately by default. In Outlook Express, clicking the Send button places your message in your Outbox. You then need to take an additional step to actually transmit the message. To do this, click the Send and Receive button in the toolbar at the top of the window.

Most e-mail programs provide a means for you to save e-mail addresses in an address book. When you compose new messages, you can then choose from this list.

Reading Your Mail

To check for incoming messages from the Internet Explorer window, click the Mail button on the toolbar and select Read Mail. This runs whichever mail program you are using. Enter your password if requested. Then use your e-mail program's command for checking mail.

Replying to Messages

Most mail programs let you reply to an incoming message rather than composing a brand new message in response. This saves you the trouble of entering the person's e-mail address or a new subject. The procedure for replying to a message varies from one program to the next. Look for a Reply button or command in the window you use to view incoming mail.

Deleting Messages

After you are done with a particular message, you can highlight that message in the message list and press the Delete key or click a Delete button. In some programs, deleting a message simply moves it to a Deleted Items folder. It is

not really gone until you delete the contents of that folder. To actually get rid of such messages, get into the Deleted Items folder and delete the items from there by using the Delete key or Delete button.

10.7 USENET NEWSGROUPS

Usenet newsgroups are electronic discussion groups through which people with shared interests exchange information and ideas. Usenet itself is actually a separate computer network but most Internet hosts provide access to Usenet, so Internet users can participate in its newsgroups.

Newsgroup articles are stored on a computer called a news server. To read the articles, you need a program called a newsreader. Many Web browsers now include newsreaders. The newsreader shows you a list of current articles in any newsgroups you choose to view and you can decide which ones you actually want to read.

The Internet also features tens of thousands of electronic mailing lists covering a huge range of interests. After you subscribe to one of these lists, you receive copies of all the mail sent to the list and can send mail to all the subscribers. It is rather like finding a group of electronic pen pals. There are even sites, such as Liszt site that help you track down mailing lists of interest to you.

10.8 SUMMARY

INTRODUCTION TO INTERNET

The Internet is simply a series of computer networks linked to one another around the world, communicating with one another. A simple example of network of computers might be given as all the computers linked to one another within an office or school building. The Internet is many tens of thousands of these networks communicating with one another, like a big net or web. These computer networks are physically linked to one another with telephone, fiber optics cables or satellite, etc. Internet is thousands of computers, spanning all over the world. New computers and users are being added to Internet everyday and it is growing at an exponential rate. The Internet is transitory, ever changing, reshaping and remolding itself.

INTERNET ADDRESSES

Internet E-mail addresses are used to identify a particular user on the Internet for sending an electronic message and the Uniform Resource Locators (URLs) are used to identify a Web server, a computer that makes information available via the World Wide Web. The URLs are typed in the Internet browser programs to access and display a particular page of information.

BROWSING THE WEB

Browsing the Web means jumping from site to site to access information. Programs designed for this purpose are known as Web Browsers or Internet Browsers. Most popular browsers are Microsoft's Internet Explorer and Netscape Navigator. To access a page on the Web, you can type the URL for the page and press Enter key or click a link that leads to the desired page.

SEARCHING FOR SITES

Many search engines such as Lycos and Alta Vista are designed to search for sites that contain information you are looking for. While using a search engine, you type the keyword in a text box labeled Search or Go and then click the search button. The search results include a list of relevant sites with a title which is also a link to that site and a brief description.

DOWNLOADING AND INSTALLING SOFTWARE

Internet is very often used for downloading software. It saves software manufacturer the cost of creating, packing and shipping disks. Many files you download will be compressed to reduce the download time. Some may decompress and install themselves automatically. Others may be compresses zip files having an extension of ZIP or self-extracting EXE files. You can use the Windows WinZip program to unzip these files before installing.

SENDING AND READING E-MAIL

Sending E-mail is one of the most common tasks performed on the Internet. Many E-mail programs are available for this purpose. For example, Eudora is

a specialized mail program to send, receive and help you manage your E-mail. Windows also has a mailing program called Outlook Express. In addition, many browsers also have built-in E-mail utilities.

USENET NEWSGROUPS

These are electronic discussion groups for exchanging ideas and information on specific interests over the Internet. Internet has thousands of mailing lists covering huge range of interests. After you subscribe to one of these, you receive copies of all the mail sent to the list and can send mail to all the subscribers.

10.9 EXERCISE

1. Fill in the blanks.
   i) The major language of World Wide Web is .....
   ii) URL stands for .....
   iii) ..... is used to identify a particular user on the Internet for communication.
   iv) Internet Explorer is a .....
   v) File ..... means translation of file into a coded format that occupies less space than the original file.
   vi) ..... is a company through which you can access Internet.
   vii) ..... is an instantaneous electronic message from a sender to a recipient or recipients.
   viii) ..... is a collection of millions of computers linked to one another around the world and communicating with each other.

2. What is Internet? Explain.

3. What is a Web browser and what is meant by surfing the Web?

4. How are you going to search the information you are looking for on the Internet?

5. What is meant by file compression and how is it useful?

6. How are you going to create and send an e-mail message to a person?

7. What are search engines and in what manner they contribute in searching sites?

Glossary

Access Time	Time required to perform a read operation.
Address Bus	A unidirectional bus that carries address code from the microprocessor to the memory to select memory location for a read or a write operation.
Application Software	Software used to carry out particular tasks and achieve specific results.
Arithmetic LogicUnit(ALU)	A part of the computer that performs all the calculations and comparisons.
Asynchronous Transmission	A type of transmission in which data is being transmitted as individual characters. The time interval between the characters varies and each character is preceded by a start signal and terminates by a stop signal which are used by the receiver for synchronization.
Baud	The number of line signal variations per second. It also indicates the rate at which data is transmitted on a line.
Browser	Program designed to let you access and navigate the Internet. The most widely used browsers are Internet Explorer and Netscape Communicator.
Bus	A group of parallel strands of wires for transmitting binary information in the computer.
Bus Topology	A type of topology in which the transmission medium is normally a single cable to which all the devices are attached. Each transmission propagates along the length of medium and is received by all the other computers connected to the medium.
Byte	A group of eight bits.

Character Printer	A printer that prints one character at a time such as dot matrix and daisy wheel printers.
Circuit Switched Network	A mode of operation of a network in which communication path is first established between the source and the destination and this is used exclusively for the duration of the call or transaction.
Client	A computer on the network that accesses resources that are shared by other computers.
Clipboard	A feature of Windows that lets you easily copy or move data from one program to another using Cut, Copy and Paste commands.
Coaxial Cable	A type of transmission medium consisting of a center conductor and a concentric center conductor. It is used when high data transfer rates are required.
Computer Integrated Manufacturing	The name given to Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM).
Computer Aided Manufacturing (CAM)	It makes use of computer systems to assist in planning and management of production operations.
Computer Aided Design (CAD)	It makes use of computer systems in the creation, modification, analysis and optimization of design.
Computer Crime	A crime committed by means of expert use of computers for theft, burglary, fraud, murder, etc.
Computer Hardware	The physical components of a digital computer.
Computer Network	An interconnection between two or more computers so that they can communicate with each other.

Computer Software	Computer programs written in a programming language to solve particular problems.
Computer Virus	A small hidden program on a floppy disk or hard disk which can spread from computer to computer and damage programs, files and computer hardware.
Control Bus	A grouping of all the timing and control signals used to synchronize the operation of the microprocessor and other computer devices.
Control Unit	A part of the computer system that directs and coordinates the operations of the entire computer system. It is part of CPU.
Copyright	Branch of law which protects creative works from unauthorized use by other people to allow the creators to benefit financially from their works.
Cycle Time	Time required for the memory to perform a read or write operation and then return to its original state ready for the next operation.
Data Bus	A bi-directional bus that transfers binary information between the microprocessor and the memory.
Data Communication	The process of transferring information from one point to another.
Data Protection	Protection of the rights of the individuals against misuse of personal information by organizations that hold the information.
Dedicated Server Network	A network in which one or more computers are dedicated to act as servers and others are clients.
Desktop	The first screen you arrive at when you turn on your computer.

Dynamic Memory	Semiconductor memory in which the stored information will not remain permanently stored, even with power applied, unless the information is periodically rewritten.
E-commerce	It refers to maintaining business relationships and selling information services and products by means of telecommunication networks.
E-mail	An electronic instantaneous message from a sender to a recipient or recipients over a network.
Fiber Optics	A type of transmission medium over which data is transmitted in the form of light waves or pulses for high speed communication.
Firmware	An intermediate form between hardware and software which consists of software embedded in electronic devices during their manufacture.
Full-duplex	A type of information exchange method between two communicating devices whereby information can be exchanged in both directions simultaneously.
Graphical User Interface(GUI)	A user-friendly operating environment for computer, based on pictures, buttons and menu options.
Groupware	A software that provides facilities to collaborate among users for workgroup computing.
Hacker	A computer expert who uses personal computer to break into and temper with computer systems.
Half-duplex	A type of information exchange method between two communicating devices whereby information can be exchanged in both directions alternatively.
Hypertext Markup Language (HTML)	The major language of the Internet's World Wide Web. Web pages are written in HTML.

I/O Processor	A processor used to perform the I/O operations so that the CPU is available to spend time on more difficult computations.
IC Chip	A silicon chip that consists of miniature logic circuits etched on it.
Information Technology	The use of modern technology to aid in storage, processing, analysis and communication of information.
Input Devices	A variety of devices used to enter information in a computer and convert it into binary pulses recognized by it.
Instruction Code	A group of bits that tells the computer to perform a specific operation.
Internet	A series of computer networks linked to one another around the world for communication.
Internet Service Provider (ISP)	A company that provides dial-up or dedicated connections to the Internet for a fee.
Laser Printer	A printer that uses laser beams and electro-photographic technology for high quality and fast speed.
Line Printer	A printer that prints a line at a time such as drum and chain printers.
Local Area Network (LAN)	A network that consists within a limited geographical area such as a building or a university campus.
Mail Merge	A feature of word-processing programs that allows you to produce documents each of which includes for example, a different name and address.

Medium	A communication line that carries information such as telephone lines or coaxial cables.
Memory Address	A number that points at a location of a word in memory.
Memory Cell	An electronic cell used to store a single bit (0 or 1).
Memory Word	A group of bits in a memory that represents information or some type of data.
Microprocessor	The central processing unit of a microcomputer.
Microwave	A type of communication medium based on electro-magnetic radiation by means of transmitting aerial and receiving antenna or dish.
Modem	The device that converts binary (digital) data into an analog form prior to transmission over a telephone line and converts the received signal back into its binary form.
Modulation	The process of transmitting a sequence of 1s and 0s over telephone lines by varying the amplitude, frequency or phase of a sine wave.
Multitasking	Running two or more programs simultaneously.
Network Operating System (NOS)	An operating system that provides all the features required to communicate over the network to access network resources to share them.
Network Topology	The way in which the nodes of a network are interconnected.
Open Systems Interconnection (OSI)	A standard model of a data communication system developed by International Standards Organization (ISO) to facilitate a communication system in which equipment from different vendors can communicate with each other.

Output Devices	A variety of devices used to convert the binary output of digital computers into human readable form.
Packet Switched Network	A mode of operation of a network in which each message transmitted through the network is first divided into a number of smaller units known as packets. Each packet contains addressing information and the packets are reassembled at the destination
Peer-to-Peer Network	A network in which every computer is capable of playing the role of client, server or both at the same time.
Plotter	An output device used to produce hardcopy of graphs, maps, engineering drawings and machine components.
Protocols	A language and set of rules that nodes agree to use to communicate over a network.
Random Access Memory (RAM)	Memory in which the actual physical location of a memory word has no effect on how long it takes to read from or write into that location.
Receiver	A device that receives the information.
Register	Memory cells inside the microprocessor to temporarily store binary information during the operation of computer.
Resolution	The sharpness or quality of picture or text displayed on monitor or printed on printer.
Ring Topology	A type of network topology in which each computer is connected to its nearest neighbor until all the computers are connected in the form of a loop or ring.

Satellite	It serves as a relay station for the transmission of signals generated from the earth. It is used mostly for long distance communication.
Sequential Access Memory (ROM)	Memory that can be written into (programmed) only once during its manufacture.
Server	A computer on the network that shares resources for others to use.
Simplex	A type of information exchange method between two communicating devices whereby information can be passed only in one direction.
Simulation	A mathematical model of a real system in the form of a computer program.
Spreadsheet	A grid of rows and columns in which you type numbers and text.
Star Topology	A type of network topology in which there is a central computer that performs all switching functions.
Static Memory	Semiconductor memory in which the stored information will remain permanently stored as long as power is supplied and does not require periodical rewriting of information.
Synchronous Transmission	A technique to transmit data between two devices connected to a transmission line in which characters are normally transmitted in the form of blocks. The transmitter and receiver clocks are synchronized.
System Software	A set of computer programs to control the operation of a computer.
System Software	Computer software designed to control the operation of the computer.
Transmitter	A device from where the information is sent.

Uniform Resource Locator (URL)	These are used to identify a Web server, a computer that makes information available via the World Wide Web. You type it into a browser to go to and display a particular page of information.
Universal Production Code (UPC)	Bar code printed on products that includes brief description for producing a bill in a computerized retail checkout system in stored.
Wide Area Network (WAN)	A network that spans a large physical area, connecting several computers across cities, countries and continents.
Word Wrap	It means as you type a document, the word processing program "wraps" the text to the next line when you reach the right margin.
Workgroup	A collection of individuals working on a task in a network environment.
World Wide Web (www)	This is where most of the people find information on nearly any subject on the Internet.

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